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THE

JOURNAL OF SCIENCE.

SEPTEMBER, 1880.

I. REPORT ON SCIENTIFIC SOCIETIES.

By Dr. C. K. Akin.

(Concluded from p. 493.)

Pesth, July 5, 1870.

My Dear Sir,

In my previous communications, at least as I take it, I have strictly kept to the terms under which the Royal Commission has been instituted, and in my interpretation of which I was mainly governed by the document printed among the reports of the British Association for 1869, and which, presented in the shape of a memorial to Government, led, if I am rightly informed, to the appointment of the Royal Commission. According to the document adduced, the objects of the proposed Commission were stated to be, to consider—

"1. The character and value of existing institutions and facilities for scientific investigation;
"2. What modifications or augmentations of the means and facilities that are at present available for the maintenance and extension of science are requisite; and—
"3. In what manner these can be best supplied."

In the words of the report, also, in these points is "involved the whole question,"—to some discussion of which I may consequently, as I conclude, devote this letter, without being guilty of overstepping proper limits,—the "question," viz., concerning the mutual relations—

Of Science and the State.—I have lived long enough, and have had sufficient experience both of science and the world, not to over-estimate the value of knowledge to man or to mankind; and although I should be sorry to back up the statement of Pascal that the search after truth were an occupation uncongenial to human nature, yet observation has convinced me that, in the actual state of society, it is not practicable, and therefore not desirable, that more than a very limited number of persons should follow, or be induced to follow, this calling. Now, if we wish to form a fair and unbiassed opinion or estimate of the importance of science and the recognition it receives, we ought to compare it exclusively with the remaining members of the sisterhood of, anciently so called, *liberal arts*. As the result of any such examination, we shall arrive at the conclusion that neither literature nor fine art is, upon the whole, so ungrateful as Science is to the man who wooes her, or rather whom she entices; or, in plain words, with neither writer nor artist does society deal so unequitably as it does with the philosopher. For, in whichever aspect we may view Science, whether in regard to intellectual worth or practical utility, surely the discoverer of truth should obtain the same reward as the author of fiction; as the former, to view only one side of the question, extends our knowledge of nature, and virtually expands man's intellect, while the latter procures us but pleasant and fleeting emotions, or helps us to while weary hours away. Still fiction, if it does not obtain recognition in the shape of rank, reaps its recompense in wealth, favour, and fame, a single successful work being sufficient to procure lifelong independence and an enduring popular name: the most splendid discoveries, on the other hand, are rewarded, if at all, by medals of no intrinsic or outer worth, and the greatest philosophers have to spend habitually in penury lives of obscurity. True, the philosopher should work disinterestedly and seek for no worldly recompense, but so ought also the poet or artist. And if society spontaneously pay its debt to the latter through voluntary contributions, as it were, both of gold and of celebrity, there is no reason why the public should not equally acknowledge its obligations to the former, if no other mode be found, by contributions levied by the State, and distinctions conferred by Government or the Crown.

Whatever may be said about the tendency of the age, the privilege of aristocracy still remains the greatest boon that can be bestowed upon any person who is subject of a State where such a distinction, by law or custom, is recognised.

For it gives that security to man in regard to the future welfare of his progeny which it is his highest ambition to achieve, and for which there is, perhaps, no other means equally efficacious; inasmuch as it naturally opens out paths to distinction, an entrance to which others have to conquer, and rarely achieve with any ultimate success worthy the pains and struggles it has cost. Although illustration in any department is not wanting to the Upper House, yet eminence in science, literature, art, or even invention, has not been considered a sufficient claim for inscription upon its muster-roll, to which distinction in law, politics, or war, or even simple wealth, so frequently gives admission. In the Bill brought into Parliament, but subsequently dropped, by Earl Russell, concerning the creation of Life Peerages, the claim of scientific men to such a distinction was admitted; but, in common with new life peers in general, they were to sign, previous to their admission to the House, a kind of self-given *testimonium paupertatis*. Now, in regard to life peerages—the grant of hereditary peerage being, as an undoubted prerogative of the Crown, always dependent on the mere will of the sovereign and his constitutional advisers—there appears to be a mode of naming, especially men of science to such a dignity, not liable to the objections which ultimately led to the abandonment of Earl Russell's Bill. Might not, indeed, new life peerages be based upon the principle admitted in the case of bishops, who now-a-days hold their peerages by Office, no more by land? And might such persons, for instance, as the Master of the Mint (whose office has been taken from science in England, when, upon her example, it has become an appanage of science on the Continent), the Astronomer Royal, and even the Presidents of the Royal Society and British Association (who should then be elected for life, and by means of a *congé d'elire*), not be properly and regularly summoned to the Lords? And instead of their being introduced, as it were, *in formâ pauperis* to the House, would it be squandering the public money if each of the above-named persons were endowed with an annual pension amounting not to the salary of a judge or bishop, but to that of a junior lord?

If Science, however, is to obtain her fair share of recognition and due meed of reward from the State, men of science will have, as happens in the world, to exert themselves and prove themselves capable of holding their own. Otherwise, or if philosophers—out of too noble instincts which the world does not appreciate—spurn honours and disdain

recompense, the spectacle, humiliating to Science and its representatives, will recur of a phenomenal intellect passing out of existence with scarcely any public notice being taken of it; and Chancellors of the Exchequer will continue to deny a national memorial to a philosoper who, in the world of mind and within a thousand years of his race's history, had no other peers but Bacon, Shakespeare, and Newton. On the other hand, the example of some living naturalists proves that by energy and perseverance much may be obtained of the State not simply in personal behoof, but for the interests of science; and the position held in public estimation by other workers proves that, if not always discriminating, society is not wholly indifferent to scientific merit placed—not under a bushel.

I trust that, neither in throwing out the preceding suggestions nor in making the above remarks, I shall be accused, upon *personal* grounds, of want of proper reserve; they occurred to me at a time when, residing in England, I naturally had changed somewhat my native horizon. In conclusion I will only further observe that, for none of the schemes explained or purposes adverted to in my previous letters, nor upon the whole, do I consider the appointment of a special Minister or Secretary of State for science or instruction at all requisite, desirable, or beneficial. On the contrary, I think it is very much to be wished that English science may continue in that state of independence and complete self-government which has become traditionary, and has produced such admirable—I might say without any exaggeration even unparalleled—results. All that is requisite, in my opinion, for the steady advancement of science, besides some *material* public aid, is such *co-operation* among scientific men themselves as in your speech at Exeter you justly laid so much stress on, as being one of the beneficial objects the British Association was designed to accomplish; and, further, such *a more systematic direction* as you similarly showed, from its Bye-laws, it was another aim the founders of the Association desired to realise in science, or in the activity of its cultivators. And in order that both these objects, as well as the results to which they should lead, be effected, it were but necessary that philosophers and scientific inquirers should adopt as their watchword *in practice* what is theoretically *supposed* to be their guiding principle in all their endeavours, and what, in the terms of a well-known formula, I will phrase by—

The Truth, the whole Truth, and nothing but the Truth.

Expressing to you my obligations for agreeing to act as the medium between the Royal Commission and myself, so far as these communications are concerned,

I remain, my dear sir,
Yours very sincerely,
C. K. AKIN.

G. G. STOKES, Esq., Sec. R.S., of the Royal Commission on Scientific Instruction and the Advancement of Science, London.

PS.—So far from being guilty of transgressing in my letters the scope of the Royal Commissioners' deliberations, I think that, on the contrary, I should myself notice the fact of having purposely confined myself to a consideration of one-half the questions only concerning which they are to make inquiry. Excepting a passing remark on the stunting effect of competitive examinations on invention, and another on the unphilosophic style of many scientific works designed for popular instruction, my observations had exclusive bearing on the advancement of science; and I will here add but one other remark having reference, like the above quoted, to scientific instruction.

Owing, in part at least, to the really wonderful facts and instruments modern science has detected or invented, a tendency is spreading to make science altogether, if I may use the word, *sensational*. Experiment, which, in the words of Dr. Young,—that should be written up in conspicuous letters of gold in every lecture-room,—has its uses "in assisting the imagination to comprehend, and the memory to retain, what in a more abstracted form might fail to excite sufficient attention," instead of being employed as a means of instruction becomes *the* object of *attraction*. In superaddition to the drawback already entailed by our consitution—in consequence of which the senses perceive only projections of things, and the mind judges of these, to use the simile of Plato, as a man confined in a cave, into which passing objects threw their shadows, could judge of what is passing in the outer world—modern modes of scientific exposition have introduced for the representation of phenomena appearances not very superior to drawings in the aid they afford to the understanding, but of a *ghostly* character, and apt to make philosophy resemble in fact, as it anciently was likened in name, to magic. The desire to produce *excitement* leads also to worse deeds—such as the furbishing up of well-known facts, so as to give them the appearance of startling

newly-discovered truths, or the throwing out of undigested hypotheses and baseless guesses as if they were accurate, well-tested theories. In this manner science becomes corrupted and debased, and the sense of truth, in lecturer and listener, blunted and confused; while precision, accuracy, and scrupulosity, being the chief ingredients of the philosophic mind, are looked upon as of no importance or value. But here, also, it is not the interference of Government, but the sincerity and moral courage of true men of science, that alone would be capable to stem the current of the spreading evil.

C. K. A.

Pesth, July 21, 1870.

My Dear Sir,

In my preceding letters I have examined into the state of science in England, and of the institutions and means subservient to its advancement, and I have suggested several measures of reform or improvement. My object in writing to you this supplemental communication is to submit some remarks concerning the state of science on the Continent; and if these do not lead me to make any additional proposals, they may yet convey information "how not to do it."

The scientific institutions most prominent in France and in Germany—and to these countries I intend to confine my remarks—are, relatively to the former, the *academy*, and relatively to the latter, the *universities;* and the sign characteristic of both is the principle of *authority* supported by a system of *centralisation*. It will be sufficient for my present purposes if my observations point to these several subject matters.

The French Academy is in some respects similar to the Royal Society, and the points in which it differs from the latter are not, in my opinion, to its advantage. In the first place, the members of the Academy are salaried by the Government, but their emoluments are not sufficient to live upon, or to keep them, so to speak, in working order; nor do they perform any specific service to Science or the State for the money. The Academy, next, is divided into a certain number of sections, according to the several branches of science, and the number of members in each section is strictly limited. As that subdivision is invariable, while the

relative importance of the sciences is fluctuating, the abuse has crept in of electing members into a wrong division. On the other hand, such a proceeding not being always practicable, highly distinguished men are excluded from the Academy for many years if their proper sections happen to be full; while if, from the dearth of cultivators or accidents of mortality, the number of vacancies happens to be great, the standard of admission is considerably lowered. The Academy publishes weekly its proceedings or "Comptes Rendus," which, from the celerity and regularity of their publication, are a valuable means of conveying rapid information; on the contrary, its transactions or "Mémoires" are issued in a very irregular and dilatory manner. The practice of examining and reporting upon communications submitted has fallen into almost complete disuse; and the prizes, which are in considerable number, are in great part awarded upon the antiquated principle of putting forth questions. I have thus rapidly drawn the most distinctive features of the French Academy, roughly yet faithfully; and I feel constrained to confess my inability to comprehend the enthusiasm which there appears to exist in certain quarters in England for this institution, and which shows itself in the desire to copy it. I have dwelt in a former letter upon the functions which any society should perform in order to be called useful, and I cannot bring myself to believe that those of the French Academy correspond in any way to the model.

I have spoken, in a former communication, in words of unavoidable eulogium of the German Universities and the position which they occupy among similar institutions in Europe. Still I do not find in their organisation anything that I should be prepared to recommend for imitation or adoption. I shall presently mention the mischievous effects which the Universities in Germany, like the Academy in France, exercise on scientific development, according to my belief, when I shall enter upon the discussion of the principles which underlie the organisation of both: here I wish merely to give an opinion upon the institution of so-called *privat-docenten*, which is generally considered as most characteristic of the German University system, and which has many admirers out of Germany. A *privat-docent* is simply a lecturer who, as a rule, receives no pay from Government or the University, but may take fees from the students: he is simply a private tutor, who, in consideration of having passed an examination or other ordeals before the proper authorities, is admitted to the use of the public lecture-

rooms. In my opinion the fellowships in the English Universities—if only Fellows were elected upon a better principle—are much more advantageous; and if the now somewhat dormant institution of lecturers or prælectors in the colleges were more largely developed, the English Universities would have nothing to envy from, and much to boast over, those of Germany in this respect.

The principal aim of the German Universities, as well as of the French Academy, is to uphold the principle of *authority* in science, which has a great many effects that are detrimental to its progress. Authority in science means infallibility, and it means also stagnation. But the essence of science is development, which is identical with change, and variation from ancient theories or received doctrines. The French Academy has generally not been favourable to novelties started out of its own precincts, as is shown by its treatment of such men as Fresnel, Fourier, or Melloni. I know also of a case in which it was found impossible to get a correction or mention of mistakes, which one of its members had happened to make, inserted in the Proceedings of the Academy, notwithstanding repeated attempts. The desire to have that done was supposed to imply *naïveté*. In a similar way the German Universities enforce a certain uniformity in the preparation of scientific students, and they measure all ability by a fixed yet arbitrary standard. Investigation must be *schulgerecht*, as it is called,—for which the French have the word *classique*, but I doubt whether there be any real equivalent in English. A mind of independent character or original turn has thus a hard struggle for existence; for, in order to get recognised, it must be fashioned on the approved pattern. Men like Davy or Faraday are consequently unknown to the history of German or French science, as their irregular preparation would have debarred them from coming under notice, and still more so from making their way. On the other hand, great errors are propagated and kept up under the wing of authority; and if once a philosopher has obtained a certain sway, or formed a so-called "school," his teaching will be kept up long after its errors have been detected. Thus certain theories are still taught all over Germany in physics which are manifestly untenable, and to attack them is punished more severely than heresy is in religion nowadays. Theories propounded by new men are generally overlooked. On the other hand, I could tell an instance in the recent history of physical science where a discovery undoubtedly not novel and manifestly incomplete has been accepted on the

Continent as an unexpected revelation proof against all doubt, because it was appropriated by names possessing authority. What constitutes authority in science it were difficult to define; yet its worship, although it be opposed to the very spirit of science, is in Germany and France, so to speak, without bounds. It were easy to prove by example that the test of infallibility is not applicable, if such a thing could be imagined, with respect to a human mind. Not only are the instances numerous where the authorities of one age have been scouted by those of the succeeding; but even in the works of the greatest among them, whose reputations were acquired on the strength of real intellect and conspicuous services, schoolboys nowadays frequently may point out glaring mistakes committed or upheld by great masters only one generation behind.

I have mentioned in a former letter the well-known fact that a German philosopher who wished to bring out some novel theory in his country encountered so many difficulties that he absolutely went mad. Another who started similar ideas about the same time, having been repulsed in one quarter, took it for granted that the same had happened to him also in another, where it was not the case, so hopeless did he consider his endeavour to obtain a hearing. Actually these ideas took wing in England, but not before, communicated also to the French Academy, they had been allowed to rest unnoticed in its archives for years (like the memoirs of Abel), notwithstanding repeated instances to have them examined. I also have it out of the mouth of one, who is actually himself a chief authority on physical science in Germany, that an early work of his, now the principal foundation of his fame, had proved injurious to his university career, for being of too novel a character. It is a slight consolation to the individuals concerned, for the anxiety or pain they have suffered, to have had their names recently enrolled on the list of members of the French Academy, or to have received an honorary title from a German University; and the damage which is done to Science by such proceedings, in all cases serious, is in many irreparable. Authority, whether exercised by academies or universities, would have its uses if it facilitated the endeavours of students during the early and more trying periods of their career, in which encouragement and aid are most welcome and needed; but if, instead, it check or impede novices, and establish merely a kind of confraternity, the chief end of which is to keep new men out as long as feasible, and to uphold its own sway, I make bold to say that the liberty of thought

reigning in England, notwithstanding its abuses, is a far more valuable safeguard for Science, the very life of which is progress. Now, if the Royal Society, transformed into or superseded by an academy, were to arrogate to itself that kind of domination which the Académie des Sciences exercises in France, or if the English Universities endeavoured to absorb all the intellectual life of the nation, or to fashion it in their own way, as is the case in Germany, the superiority of England which has made it the head-quarters of scientific progress, and the mother country of so many amateurs more distinguished in Science than most French academicians or German professors, would probably be gone.

These are the reasons which induced me to express in my last letter the hope that liberty and self-government may be preserved to science in England, henceforth as heretofore; and to deprecate, as intimately connected with the subject, the creation of a special department, or the appointment of a new minister for science or instruction, or, as it is sometimes significantly called, for education—tending towards *State centralisation*. It is altogether erroneous to suppose, as I could prove it, that Government supervision on the Continent has been in any way whatever to the advantage of Science. It would have been so if scientific institutions in Germany or France were better organised than in England; if there were a proper division of labour between them; and if each had its distinct special object. Without entering into any examination of facts, I will merely state—what must be evident to anyone who has studied the subject—that nothing, on the contrary, can exceed the confusion of the multiple scientific establishments at Paris, for instance, involving the frequent abuse called in French *double emploi*,—while the want of any real organisation in the higher branches of instruction, or the scientific institutions, is shown by the existence of the so-called *cumul*. The former defect implies the existence of several posts for the same thing or subject, and generally also the absence of a proper care for others; while the latter means the union of several offices, laboratories, &c., in the hands of one man, to the detriment of others who have none. The unsatisfactory state of science in France, the head-quarters of centralisation, has been frequently acknowledged of late by the very highest authorities of the country. It has led to the creation of a special establishment, as yet very imperfectly developed and not irreproachably planned, destined to

procure some amelioration; and perhaps it may not be the exclusive result of personal considerations that, beside the ministry of instruction proper, there has been recently created in France another public department, designated as the Ministry for Letters, Science, and Art. Hitherto Science had been neglected by the ministers who controlled it, but took principally care of Instruction. This would certainly happen also in England, if a so-called Minister of Education had to take care of both; and I doubt whether Science would not be an absolute loser by getting the patronage of Government in any such form.

If the prevention of evil be an object of as great importance as the promotion of good, which you will probably allow, perhaps the warning I have ventured to convey in this letter may serve a purpose as useful as the positive suggestions my previous letters contained. Trusting to your kindness to communicate this letter also to the Royal Commission,

I remain, my dear sir,
Yours sincerely,
C. K. AKIN.

Prof. G. C. STOKES, Sec. R.S.,
London.

PS.—Perhaps I ought to have taken some notice in former letters of scientific establishments such as the Greenwich Observatory, the British Museum, the Kew Gardens, &c. I will now content myself with stating that they ought to be utilised in connexion with the proposed Royal College, in a manner self-evident, and which, therefore, I need not detail here.

C. K. A.

[Our readers are of course aware that the above letters were not published by the Royal Commission for whom they were originally written; nor can it be said that their spirit has at all perceptibly influenced the "Recommendations" which the Commissioners finally issued. It will be seen that Dr. Akin is far from holding that English Science would be greatly benefitted by a wholesale adoption of the features of the French Academy of Sciences or of the German Universities. This is the more probable as in such borrowings and imitations we generally contrive to copy unimportant details, leaving out of sight what is of primary importance.

"Wie er räuspert und ure er spukt
Habt ihr ihm alle abgekuckt
Doch das Genie, ich mein den Geist
Man nicht auf der Wachtparade weist."

Who will not be reminded of an unfortunate attempt to ape Germany in matters military? Since the date of Dr. Akin's letters, however, matters have become in England much worse. Examinationism is more and more rampant, and is eating away the intellectual life of the nation. More and more we are producing crammed puppets instead of discoverers and inventors, and with a marvellous infatuation we seem well content with this state of things, and even, Heaven help us, entertain a sort of contempt for original research. Dr. Akin rightly holds that the mere admission of "Science" at University examinations, on the same footing as "Classics" and "Mathematics," will be of no avail. So long as honours and the more tangible prizes, such as fellowships, can be obtained by merely passing examinations in the researches of others, what the candidates are to be examined in is a matter of supreme indifference. But we do worse; we formally exclude original investigation. We do not allow it to pass current in the land, and we close our ears to all warning voices, whether, like that of Dr. Akin, they come from afar, or are uttered in our midst like that of Dr. H. C. Sorby.—ED. J. S.]

II. MENTAL EVOLUTION.

By J. FOULERTON, M.D., F.G.S.

IN a lecture recently delivered by Mr. Romanes, F.R.S., at the Royal Institution, on the subject of Mental Evolution, he said he had two objects in view—first, to show how Mental Evolution, supposing it to be true, could be traced through all the forms of animal life, from the earliest appearance of irritability, as manifested by the direct and immediate contraction of the simplest organic forms on the application of stimuli, to the highest manifestations of thought as exhibited by man; and secondly, knowing that these last or highest phenomena of Mind were not admitted by a certain school, most ably represented by Mr. Mivart, to be the product of Evolution at all, but to constitute an entire break in a chain of Mental Evolution continuous up to that point, he would endeavour to prove that there was in reality no such break.

I will not stop to discuss the fact, admitted by all, that Mental Evolution is true up to a certain point, and that all the phenomena of sensation, reflex action, intelligence, &c., common to man and the lower animals, have been so brought about; nor the way in which Mr. Romanes traced this through the various kinds of animals, from the lowest up to man; but will confine my observations solely to those mental phenomena manifested by the human species, which immeasurably transcend anything of the kind to be found in

the lower animals, and which the school of Mr. Mivart deny being the product of Evolution at all; for though I agree with Mr. Romanes in thinking that they are, I differ from him as to the proofs on which that opinion should rest.

It matters little for the present argument in what these phenomena consist, since the fact that there is a wide gap which separates the highest phenomena of the mind of man from those of the lower animals is admitted by all. Now the line of argument adopted by Mr. Romanes was to show *how* that gap might be *intelligibly* filled in by a series of hypothetical connecting-links,—highly-developed anthropoid apes, predecessors of man as we now find him pretty much the same all over the world, or at any rate without anything that can be called a break in his mental continuity,—and was of opinion that if he succeeded in doing so it was as good as showing that the gap had been filled in, taking into consideration that up to the point when the gap began Mental Evolution was an admitted fact and Organic Evolution was admitted in its entirety. It is not necessary here to say anything of the way in which he accomplished his task; we will admit that it was done as well as it was possible to do it, and that the process he described was one which might actually have happened, and that speaking apes really did exist. It may in passing be stated that, only a few days before Mr. Romanes told us of his hypothetical speaking apes, Prof. Dawkins told his audience, at the Geological Society, that certain flint implements found in strata anterior to the time when he believed it possible for man to have come into existence, must therefore have been fashioned by an anthropoid ape, and at all events held that this was more probable than that man was then in existence.

Now, supposing Mr. Romanes to have shown how the gap in Mental Evolution might have been filled in, I do not think this is the way to prove mental or any other kind of evolution. When Darwin, twenty-one years ago, endeavoured to prove the theory of Evolution as the origin of species, he did so not only with a full knowledge of the wide and apparently unbridgable gaps separating and isolating organisms, and of the then absence of connecting-links, but prophesied—and prophesied truly—that this would be the great difficulty in the way of the acceptance of his theory. But Evolution was true nevertheless, for it depended upon two facts known to everybody from all time, just as it was known that apples fell to the ground, but the significance of which had never been fully appreciated—first, that every

organism is the offspring of a similar organism; and secondly, that the offspring is never exactly like the parent: these two factors, Descent with Variation, constitute the groundwork of Evolution. Connecting-links have during the past twenty-one years come in abundantly, and the apparently unbridgable gaps have, many of them, been bridged over, but they have in reality added nothing to strengthen the fact that Evolution must have taken place: all they have done—and it is no doubt very important, though of secondary consideration—is to show the method by which, and the order in which, Evolution took place. So much for Organic Evolution as the origin of species: now what I maintain is, that unless there is similar evidence for Mental Evolution it will be useless to endeavour to supply its place by any attempt to discover mental missing links. Mental Evolution must be as independent of Mental Palæontology as Organic Evolution of Organic Palæontology; and such is I believe the case, and that the evidence for both is precisely similar, viz., Descent with Variation. Everyone unhesitatingly feels and admits, in the daily affairs of life, that our thoughts and our actions—which are the outcome of our thoughts—are always preceded by motives, so that we have an unbroken descent for our thoughts during the whole of our lives, and as at birth the human species is as much wanting in those highest mental faculties of which we are speaking as any of the lower animals, it follows that these faculties are connected by an unbroken line of descent with those which man has in common with them, and which are admitted by all to be the product of Evolution. But motives do not always give rise to the same thoughts in different individuals, which is to be accounted for just as we account for variation in the lower animals—by that inherited difference which always accompanies descent, and without which there would be no Evolution.

There is also what may be called a material aspect of thought,—I mean that change in organic tissue which always accompanies thought; and it is just as certain that this change is the effect of another that preceded it, as it is that any motion whatever is the effect of a previous motion, but the change which preceded it and acted as the cause could only be that which accompanied the motion. Thus in whatever way thought be regarded, whether as a feeling or physical change, there is no escape from the conclusion that, like everything else, it is an effect of something that went before; but this is what the opponents of Mental Evolution

are obliged to deny, for it is absolutely fatal to their hypothesis.

The analogy between Mental Evolution and Organic Evolution might be carried a step farther. I allude to the influence of Natural Selection. If there is one department of Mind more than another which is supposed to be in a peculiar manner not the product of Evolution, it is the moral faculties; yet it would not be difficult to show that they are just as much the result of Evolution with Natural Selection as anything else in the whole of biological science —and fortunately it is so, for it is the certain and sole guarantee of their ultimate supremacy, though the quality of the morality may be very different from what commonly goes by that name, and, instead of the angry and vociferous dogmatism of conflicting creeds, which is an unmixed curse, it will be a product of the still small voice of Natural Selection, and an unmixed blessing. The former had to precede the latter, just as the Stone Age had to precede the Iron, just as Savagery had to precede Civilisation: there is just as little doubt in the one case as in the other which of the two Natural Selection will seize hold of.

As the proofs of Mental Evolution are precisely similar to those of Organic, so likewise are the arguments employed against it. Indeed there is but one answer possible in either case, viz., Special Creation, which means that there are organisms without parents, thoughts without motives. The former hypothesis has, in a wonderfully brief space of time, been completely routed along the whole line; even the poor Bacteria—the last shred of a theory once so wide that it included every species past and present—have at last had to give up their claim to any special intervention on their behalf.

The latter hypothesis, however, still holds its ground, but is a product not of the common sense of mankind, which always acts on the belief engendered and verified by the constant experience of their own feelings, and what they see in others, that thoughts and actions are always the outcome of motives: indeed the whole business of life is based upon that supposition, so that the burden of proof rests entirely with those who maintain a contrary opinion, and clear and distinct evidence must be given of thoughts arising without motives,—an exploit which may reasonably be presumed to be impossible but which nevertheless is absolutely essential to any effective opposition to Mental Evolution, just as evidence of an organism not being the product of a previous organism would be necessary to disprove Organic Evolution.

It is not, however, on scientific grounds that the opponents of Mental Evolution really take their stand, but rather, as Mr. Romanes pointed out, from an idea that if it be true then the Soul cannot be Immortal. Now let us suppose any one were to maintain a contrary opinion, and to affirm that Mental Evolution is a proof that the Soul is Immortal, how could such a conclusion be shown to be any less true than its opposite? It would certainly be nothing new for a supposed opponent of religious dogmas to become a pillar of the church; in fact every scientific opinion has passed through these two stages. Astronomy, Geology, the Origin of Species, and a host of others have at first been regarded as implacable enemies of religious dogmas, and then as their staunchest allies, and there is no reason why Mental Evolution should not go through a similar process. The fact is that Science is neither the enemy nor the ally of religious dogmas, and hence the reason why it is so differently regarded by different persons and at different times. Science rests upon experience, and nothing is good in Science that cannot be proved by experience, which is the touchstone for trying every fact and theory; now religious dogmas have nothing whatever to do with experience.

The Soul may be said to be the central idea of all such dogmas, yet any attempt to define, in terms of experience, or, in other words, to materialise the soul, would be generally considered as most irreverent. In the June number of this Journal a review was given of a work in which such an attempt was made, and, though the reviewer did what he could to put it in the most favourable light, it only adds another instance to the many that have preceded it of the hopeless nature of what, were it a fact, would be too evident to admit of doubt. This is no argument whatever against the reality of the Soul, as there may be many things in heaven and earth which are not dreamt of in the philosophy of experience, but it is an absolute bar against any attempt to test the teachings of the latter by an appeal to the former, or *vice versa*; for what relation can there be between that which wholly ignores the tests of experience and that which knows no other test but experience?

III. A CHANGE OF FRONT.*

By J. W. SLATER.

THOSE authors and orators who consider it their duty to criticise the spirit and the results of modern Science,—especially of Biology,—from a religious point of view, have of late somewhat altered their position. Physical research is no longer declared necessarily, or even generally, atheistic in its tendencies. The past duration of the earth is no longer limited to the old "4004 years before the vulgar Christian era;" creation is now regarded as a continuous process, not as an engineering operation completed at a certain date according to contract. The cosmogony of Kant and Laplace—the so-called nebular hypothesis—is accepted as perfectly compatible with theism, and even with the tenets of revealed religion. The independent origin of every animal and every plant is not now insisted upon, and even the high antiquity of the human race is treated as an open question. This is much; and if we look backwards for a few moments, and read the sermons, the speeches, and the review-articles which a quarter of a century ago were discharged at modern research, we must feel duly thankful for the progress that has been effected. But we should beware of supposing that all the fundamental doctrines of the New Natural History are fully and finally accepted by "parsons, poets, novelists, lawyers," and generally speaking by outsiders of culture and intelligence. There are certain reservations, unpleasantly like the "saving clauses" in an Act of Parliament, which greatly qualify, if they do not altogether annul, the meaning of the concessions above mentioned. Nay, it becomes sometimes doubtful whether these admissions are anything more than a change of front,—a "flank attack" substituted for the more direct opposition which Evolutionism has had, till recently, to encounter. In the works which, as types of their class, I have selected for the basis of my present considerations,

* The Spirit of Nature, being a Series of Interpretative Essays on the History of Matter from the Atom to the Flower. By HENRY BELLYSE BAILDON, B.A. Cantab., Member of the Pharmaceutical Society. London: J. and A. Churchill.

God and Nature. By the Right Reverend the LORD BISHOP OF CARLISLE. "Nineteenth Century."

these features are revealed, though in very different forms and degrees. Man is still regarded as differing from the rest of the animal kingdom not merely in degree, but in kind. Nature is still declared perfect, and defended against the charge of "cruelty;" pain and suffering, if they cannot be fairly denied, are explained away; beauty is pronounced substantially universal, and is supposed to have been called into being for the special delectation of man; and last, but not least, the purposes of God are assumed as fully known and understood, according to the old use and wont of teleologists.

Between the two treatises before us there is a well-marked difference. The Bishop of Carlisle approximates much more closely to the position of modern man of science than does Mr. H. B. Baildon. He may, indeed, justly claim our warm thanks for having drawn a distinction which, though it has escaped the notice of mankind for ages, must, when once pointed out, be accepted as strikingly natural. We hear, from time to time, complaints of the "atheistic tendencies" of modern Science, and of the dangers to be apprehended in consequence. The Bishop replies that "We want a new word to express the fact that all physical science, properly so called, is compelled by its very nature to take no account of the being of God: as soon as it does this it trenches upon theology, and ceases to be physical science. If I might coin a word I should say that science was *atheous*, and therefore could not be *atheistic;* that is to say, its investigations and reasonings are by agreement conversant simply with observed facts and conclusions drawn from them, and in this sense it is *atheous*, or without God. And, because it is so, it does not in any way trench upon *theism* or *theology*, and cannot be *atheistic*, or in the condition of denying the being of God."*

The distinction thus drawn is perfectly satisfactory; but the practical application of the principle turns upon the recognition of the boundary line between the spheres of theology and of physical science, between the *natura naturans* and the *natura naturata*. The necessity of respecting such a "scientific frontier" the Bishop sees and enforces. He holds that it is "not a mere arbitrary line to be laid down by treaty, but is like one of the great watersheds of Nature which no human arrangements can alter." This we fully grant, but we fear that it will be less easily traced out and recognised. Where is the legitimate boundary of physical

* It must be admitted that Mr. Baildon draws a similar distinction, though he does not employ the happy term "atheous" as contrasted with atheistic.

science? According to the author a naturalist has no right, "upon the strength of investigations purely physical, to deny the existence of moral order, or of beneficence as an attribute of the Creator, if a Creator there be." Such denial, he contends, is an overstepping of the boundary.

I must here draw a distinction: the denial of beneficence in the Creator, on the strength of scientific researches, is doubtless illegitimate, and may be viewed as atheistic. But so long as the naturalist merely denies that he can find indications of such beneficence in the mutual relations of the organic world, he is, as it seems to me, on his own side of the frontier. And now for the converse transgression to that which the Bishop signalises. An author, knowing or believing from revelation, or from *à priori* considerations, that there exists a moral order in the universe, and that the Creator is beneficent, proceeds to use this belief as a datum in discussing the origin of species. If Ernst Haeckel crosses the legitimate boundary of physical science from the one side, so assuredly does Mr. H. B. Baildon from the other.

In marking out the frontier line which we are considering the Bishop of Carlisle insists, further, that physical science does not include the study of man, save "as a creature having certain material attributes, and leaving certain material marks of his existence in past ages." The science of necessity, he continues, "leaves out of consideration all that is most interesting to man or which makes man most interesting." Hence we are warranted in inferring that he would exclude from the domain of physical science all inquiries into man's moral nature, and would count attempts to explain the origin of our ethical codes as illegitimate.

But now comes the great difficulty: if a full consideration of one animal species—*Homo sapiens*—is not within the competence of Science, how is it with others? If one part of Nature is relegated to the sphere of the metaphysician or the theologian, what of the rest? The Bishop's reply is substantially that man is not an animal, not a part of Nature. "Putting aside all questions of immortality, it is not difficult to conclude that mankind possess attributes which do not belong to other creatures, and which make it necessary, in examining the world, to put man in a class by himself.

Here, then, all agreement ends. Whilst fully admitting the principle of a boundary line* I must hold man as an

* *See* Journal of Science, *passim*.

integral part of Nature, and maintain that as such he may be legitimately studied by the scientist. The Bishop's reasons for placing man "in a class by himself" have already been weighed elsewhere, and may safely be pronounced unsatisfactory. Will, purpose, thought, may all be claimed for the lower animals, though of course in a very much smaller degree than they are met with in man. But it is utterly unwarrantable to found absolute distinctions upon mere differences in grade.

From the author's comments on the materialist epigram, "Without phosphorus no thought," I do not dissent. It might be interesting to determine whether the proportion of phosphorus in the brains of different animal species, in that of one and the same species at different periods of maturity and decay, or, again, in individuals of the same species which during life have differed in mental power, bears any proportion to their respective degree of intelligence.

The Bishop says, with reference to the moral feelings, "I can discuss them, I can guide my conduct by means of them, I can feel ashamed of this or that failure in upright or high conduct." True, but domestic animals also can feel ashamed of wrong doing, irrespective of the prospect of punishment.* We read that a murderer "has no doubt as to the fact that the person who did the deed of darkness years ago is the same person as he who feels the pangs of remorse to-day.† Every material particle in his body may have changed since then; but there is a continuity in his spiritual being out of which he cannot be argued." In so far as this consideration is an evidence against what is commonly known as Materialism,‡ I appreciate its value; but if it be urged in proof of the continuous personality of man as distinct from his fellow-animals, I must demur. Cases are known of brutes remembering both kindnesses and injuries for terms of years long enough to allow of the exchange of every material particle in their bodies; yet such an animal never doubts that it is the same being which was injured long ago, and in taking the opportunity for revenge it asserts its continuous personal identity just as distinctly as does the criminal supposed by the author. I see, therefore, here also no justification—far less necessity—for the old practice of putting man in a class by himself. On the contrary, it will doubtless appear that by this very

* Journal of Science, 1875, p. 423.
† Savages do not seem capable of remorse.
‡ Hylozoism; Apneumatism.

separation the study of human nature has been greatly obscured. In psychology, in sociology, in ethics, just as is the case in morphology, embryology, and physiology, we shall gain much by proceeding from the simple to the more complex, and in viewing man not as an isolated independent being, but as a part of a coherent whole.

Let us turn now to a writer who speaks perhaps rather in the interests of æsthetics and of natural theology than of revelation, and whose attitude, as far as modern biology is concerned, is far more hostile than that of the Bishop of Carlisle. Mr. Henry Bellyse Baildon is probably a young man, which may account for the general tone of dogmatism and rashness which pervades his work, and which is rather curious on the part of one who thinks it necessary to describe himself as "naturally apprehensive, sensitive, and timid." His declared object, a crusade against materialism, is one with which I heartily sympathise. But I fear that he includes under the term "Materialism" doctrines with which it has no necessary connection. What, for instance, must we think of the following passage?—"My general aim is not so much to discredit Darwinism proper, as held by the original author of the doctrine, as to attack, and if possible demolish, that materialistic and atheistic system for whose bricks Darwin himself has but supplied the stubble." For such a task his preparation has been to "read a great part"—not the whole—of the "Origin of Species." Again: "Nor does Darwin in person head the crusade of atheism." Further: "Thus in his anxiety to avow his deism (? theism) he (Darwin) banishes the action of his Deity to a remote period of the past, leaving Him as it were at the very verge of His own universe, in such a position too that He must recede continually before the advance of Science. That Mr. Darwin by no means intended to leave the deistic (theistic) idea in this perilous position may well be believed; it was his ill-timed zeal in giving his bow of belief (!) at the end of a volume, which he could not but be aware was of an atheistic flavour, that did all the mischief. His followers have seen the weakness of his position, and have many of them gone on to atheism." From these passages, and indeed from the whole tone of the book, it would seem that Mr. Baildon views the New Natural History as favourable to atheism, and as hence deserving of hostility. He gives in, truly, his formal adhesion to the great principle of Evolution. He declares that "Evolution is, indeed, but the generalisation or fulfilment of the dictum *Natura non habet saltum*, wherein lies the alpha and omega of physical

science. Whoever admits this maxim to be universally true is not only entitled but committed to a belief in Evolution, whatever cause or causes he may have to assign for the phenomenon." Yet at the same time, because man has not succeeded up to the present date in resolving the chemical elements into some one ultimate substance, he holds that "The chemical analogy threatens continued hostility to the theory of Evolution as long as that theory maintains a unity of source for all life." But to what agencies does he ascribe the development of species? With the explanations given by Mr. Darwin he is far from satisfied. As the main points in favour of the great reformer of natural history, he enumerates "the extensive modifications producible on plants and animals under domestication with artificial selection; some remarkable cases of reversion in various breeds to certain characteristics of a common ancestor; the close anatomical similarity in particular points observable in creatures of extreme diversity; the existence of rudimentary organs; and last, but not least, the absence of any definite opposition theory on an adequate scientific basis." He omits in this summary the evidence drawn from the distribution and the migration of species, from the geological record, and from embryology. He considers that the "weakness in Darwin's Darwinism" (*sic!*) lies in the insufficiency of the survival of the fittest and of sexual selection to account for the varied forms of life. In this opinion, as our readers well know, he is not singular. Many competent judges, whose writings have been criticised in the "Journal of Science," take the same view. But he does not, like Prof. Cope, raise the point that "Selection" and "Survival" fail to explain the origin of the fittest. Nor do his moral instincts revolt at the consecration which Darwin's theory seems to confer upon the most painful phenomenon in Nature—the struggle for existence. On the contrary, he accepts the gospel of competition in its full extent:—"Everything in Nature, man not excepted, is to be put on its mettle; the great meaning and moral of Nature is activity and progress, and one of her greatest functions is to stimulate man, even by what seem hardships and cruelties, to yet intenser and more divine activity."

As regards sexual selection, he considers that Mr. Darwin "has forgotten to account for the origin of the instinct for the beautiful thus assumed as existing in animals."* Else-

* He might be referred to the work of Mr. Grant Allen. *See* Journal of Science, 1879, p. 395.

where he pronounces it "difficult to perceive and highly improbable that any animal except man has the faculty of discerning between what is beautiful and what is the reverse." Yet he admits that, according to the experiments of Sir John Lubbock, certain insects possess a sense of colour, and he even speaks of "dim instincts for beauty" as present in the lower animals. But letting this pass, what is his right to assume the absence of an æsthetic sense in the animal world? Is the mineralogist justified in asserting, without analysis, that a certain ore is free from arsenic or sulphur?

What, then, are the factors which the author invokes in place of natural selection and sexual selection? He does not, with the theistic evolutionists in general, hold that development takes place upon certain divinely ordained lines; he does not say that God has implanted in every organism a tendency to variation, which under certain circumstances becomes active, and which then gives scope for natural selection to come into play. He does not suspend judgment, and urge that we must here await the results of further investigation. He simply calls in the old Paleyan "design and contrivance!"

It will be at once perceived that this is no scientific explanation of the phenomena at all. We might as well say that the unsupported stone falls to the earth because God so wills, which, though theologically correct, is scientifically inadmissible. If God has "contrived" the existence of any animal, or any particular arrangement in such animal, has he done so arbitrarily, or upon some fixed principle? The former supposition surely is unworthy of Absolute Reason. If, then, the latter hold good, the task of Science is to discover what is the principle involved, and not to remain contented with such "brave words" as "design" and "contrivance."

But there is a further consideration: the great difficulty in the way of theism has been couched in the old question "*Si Deus est unde malum?*" It is strange that the Darwinian theory, though accused of atheism, has supplied the most satisfactory reply to this perplexing query, by showing that God is—if I may use the expression—not responsible for the most striking and gratuitous forms of evil. In so doing it has, I submit, rendered a service to theism and to Christianity which will be recognised in the future. It may be useful to consider how the question had been previously dealt with. The shallow optimism of George Combe and his followers carefully confines itself to a certain class of

evils, such, namely, as are founded in the very nature of matter and of physical energy. If a man steps over the edge of a precipice he must be dashed to pieces by the action of a law necessary for the very stability of the solar system. And, by multiplying examples of this kind, these writers draw away the attention of their readers from evils which cannot be thus explained or justified, and which mainly accrue from the action of certain portions of the organic world.

Another school of teleologists—still accepting man as the measure of all things, and upholding the "perfection of Nature"—seek to show that creatures openly and palpably injurious may possibly render us some secret and unimagined service, which latter is the purpose of their existence. To this contention the reply is easy: we condemn, and seek to supersede, any human contrivance if along with much good it effects even occasional harm. How, then, can we pronounce anything a Divine contrivance for our good which inflicts upon us great harm, and whose benefits are merely suppositious? It may further be asked, if seeming evil is only kindness in disguise, may not apparent good prove to be closely masked evil?

There is another theory of evil held by the religious world, which, though of late years it has been kept somewhat out of sight, harmonises better with facts and with the results of modern science than do the optimist dreams of the "natural theologians." According to this theory venomous serpents, locusts, mosquitoes, evil beasts of all kinds, are in their nature punitive—a consequence of the fall of man.* I have met with a naturalist who contends that the entire order of Diptera, or two-winged flies, is a Satanic creation,—a profane parody on the Hymenoptera, called into being, under Divine permission, for the chastisement of man,—and who hopes to find scientific evidence of that crisis which in Scriptural language is described as man's original apostacy.

There is a further explanation of some at least of the existing evils and imperfections which meet our gaze wherever we look with eyes not dimmed by preconceived notions. The earth is a raw material which man is to "subdue." He is to drain the swamp, to extirpate the tiger and the

* It would be ludicrous, were the subject less grave, to find men who accept the Bible as a Divine revelation, and who consequently must believe that the earth is cursed for man's sake (Genesis iii., 17), and that it therefore brings forth weeds—and if weeds, why not animal plagues?—to find such men still endeavouring to explain away the existence of evil in Nature.

wolf, and the cobra; he is to develope the flowers and the fruits to higher beauty and luxuriance. He is to supersede the struggle for existence, which may be characterised as the "old covenant" of the organic world; and in doing all this he is to show himself the joint worker, the co-evolver with God.

On the design and contrivance hypothesis parasitic worms, &c., "can only be regarded as instruments of torture devised by the Creator, and whose existence no writer of Bridgewater Treatises has yet even attempted to reconcile with His infinite wisdom and benevolence."*

Evolutionism gets rid of this difficulty, but not by showing that the existence of species and their properties is a result of blind chance. Fully admitting that the animal and the vegetable kingdoms have been developed according to God-given laws of which the most advanced of us all have as yet but very shadowy conceptions, I must call attention to the following considerations:—Every theist, and assuredly Mr. Baildon, holds that *e.g.* each individual man, though procreated by his parents, is created by God. But what if a man turns out a hunchback, a cripple, an idiot, a dipsomaniac, a kleptomaniac? Shall we dare to say that this is God's contrivance; that He has designed and willed deformity, idiocy, vice, and crime? Just as little has He designed or contrived what we may call loathsome or criminal species, the aphis, the scale-insect, the screw-worm of Texas, the *Pulex penetrans*, the *Lucilia hominivora*, and legions more.

But Mr. Baildon, with a boldness that is perfectly amazing, comes forward to defend Nature against those whom he calls her "slanderers" and "libellers,"—in other words, those who cannot shut their eyes against facts. He evades the main question at issue by stating that he wishes to "confine the enquiry to sub-human Nature." Yet he elsewhere loses sight of this limitation when he says—"The impartial thoughtfulness of Nature puzzles us. We are offended to find the existence of a noxious weed, insect, or parasite cared for as tenderly as man's." But what should we think of a human government, very limited in power and wisdom, which should not merely fail to extirpate, but should knowingly and of full purpose cherish Thugs, Inquisitors, brigands, poisoners, promoters of bubble companies, and other the like human parasites and beasts of prey? Yet Nature, which

* Habit and Intelligence. By J. J. MURPHY. *See* Journal of Science, May, 1879, p. 350.

acts exactly so, is not to be denounced either as a "bungler" or accused of cruelty. We who, in old-fashioned language, "wear the shoe" are not to be allowed to say where it pinches! Mr. Baildon contends that there is no unnecessary or useless pain, and enlarges on the ennobling influences of suffering. Did he ever hear of a man who was ennobled, morally, intellectually, or physically, by a brood of chigoes in his feet, by having his palate cut to pieces by the larvæ of *Lucilia hominivora*, or by having his rest broken night after night by mosquitoes? A word about these same mosquitoes, using the word in an unscientific sense to include all the blood-sucking Culicidæ and Tipulidæ: is there any necessity for their existence at all? If such there be, it is certainly not necessary that they should suck human blood, since millions upon millions of them live and die without ever settling upon man or any other mammalian. Would not a slight change in the odour of our juices, or, if that were too difficult to effect, a slight alteration in their own tastes, solve the difficulty, and deliver mankind from much torment without injuring the insects? Surely, then, we have here a case of useless, needless suffering. It has been further ascertained, contrary to what was once dreamed, that, so far from being of sanitary utility, they serve as transmitters of disease, and that their larvæ intensify the putrefaction of organic matter in the waters. We may similarly examine the properties and characteristics of the parasites which prey upon man, creatures doubtfully even conscious of their own existence. Yet it is to such beings that Nature sacrifices the weal of man, "her first mate and conqueror and monarch!" I do not, indeed, venture to pronounce all this suffering unjust; but may certainly conclude that if a maximum of earthly enjoyment and a minimisation of earthly suffering had been the objects of the Creator, the world would assuredly have been constituted very differently from what it is.

In another respect Mr. Baildon is at variance with the teachings of the New Natural History. He asserts, *con strepitu*, that the beauty of certain organisms exists for the edification of man, and, in a passage which I cannot pronounce other than deplorable, he speaks as if Mr. Darwin, in maintaining that "all this beauty" has arisen "without design or purpose,"—*i.e.*, without reference to man,—denied the very existence of the beautiful. Now facts do not harmonise with this purposive notion of beauty. We find multitudes of creatures exquisitely coloured—Actiniæ, Crustacea, and Mollusca—inhabiting the depths of the sea.

Have their hues and their designs been elaborated in order that, after the lapse of myriads of years, some naturalist on board a *Challenger* or a *Novara* might dredge them up and be charmed with their appearance? We find the fossil remains of insects, *Buprestidæ*, *Malachii*, *Monanthia*, and others, described in Heer's "Primæval World of Switzerland."* We have good reason to conclude, from their similarity to living members of these groups, that these creatures were beautiful, and we may even argue from their existence to that of a stately and beautiful vegetation. But did this beauty arise and pass away in order that its existence might be inferentially ascertained by a few zoologists in the nineteenth century? There are other fossils displaying exquisite designs concerning which it has been well remarked that not even Paley's watch-maker Deity would "contrive" beauty in the Cretaceous epoch in order that a few traces of it might be detected in the Post-tertiary. Again, as a correspondent not long ago pointed out,† if we take the hoof of an ox, cut a thin section of it in certain directions, and examine it under the microscope with the aid of polarised light, a wonderful play of colour meets our eye. "Will any teleologist maintain that the texture of such hoofs was 'contrived' with reference to the fact that, after expiry of many thousand years, a few microscopists should detect all this beauty?"

Further, many of the most lovely organic forms, especially animal, are decidedly rare. The adventurous naturalist finds them in situations where human foot has never before trodden. Nay, some thinkers even assert, though in my opinion wrongly, that rarity is an essential feature in what we regard as beauty. Something of this notion appears to underlie the very word "homely," which our forefathers applied to objects not perhaps positively ugly, but occupying a neutral position. "Homely" surely means that which surrounds us in our daily life, or, in other words, that which is common. It is further to be noted that the most numerous species, whether animal or vegetable, those which meet us everywhere, are precisely the least beautiful, and often the most pernicious. The least attractive and the most injurious of our native butterflies are the cabbage whites. Among the commonest beetles rank the cockchafer and those "clickers" whose larvæ are dreaded as wireworms. The most numerous of all insects are the house-fly, the

* *See* Journal of Science, 1877, p. 257.
† *See* Journal of Science, 1880, p. 343.

mosquitoes, the crane-fly, &c.—devoid of grace as of goodness. With plants the case is surely similar, even though few of them possess the intense ugliness so common in the animal kingdom. But if we clear a plot of ground, and abandon it again to the tender mercies of Nature, with what will it be covered in a few years' time? Shall we find there a primrose or a violet, an orchis or a foxglove, a wild rose or a honeysuckle, a royal Osmund or an oak-fern? No; the soil will be covered with nettles and docks and groundsel, with plantains and chickweed! It is as if the beautiful was hard beset to retain a foothold, even with our utmost aid, whilst the ugly and the hurtful increases and multiplies despite our labours.

In virtue of these considerations, to which many more of a kindred nature might be added, the beauty of the organic world where it occurs can no more be pronounced especially intended for man's delight than can the ugly sights, the doleful sounds, and the loathsome odours be considered as designed for his disgust. Man is placed in the world, and must take the rough with the smooth, avoiding or overcoming the former and making the best of the latter. To say that there is a soul of goodness in all things evil is merely to give a more poetical version of the old adage, "It is an ill wind which blows nobody good." How completely this scrap of "homely" wisdom decomposes our teleology! As for the problem of evil, we must await its solution hereafter.

Mr. Baildon's work, though in one sense evolutionist, furnishes proof how much evidence will have to be accumulated before the New Natural History can be definitely established, and to collect such evidence may be less difficult than to win for it a candid and patient reception.

IV. ON SOUND AS A NUISANCE.

FOR a long time it has been well known to the medical profession that in various critical states of the human system absolute silence, or the nearest possible approach to it, is not the least important condition to be

secured. Accordingly muffled knockers, streets covered with straw or spent tan, and attendants moving about with noiseless step, are universally recognised as the signs and the requirements of severe disease. But the truth that noise is a contributor to the wear and tear of modern city life has scarcely yet been realised by the faculty, not to speak of the outside public. Consequently, whilst a zealous war is being urged against other anti-sanitary agencies, no general attempts for the abolition of superfluous noise have yet been made. We cannot, perhaps, give anything approaching to a scientific explanation why sound in excess should have an injurious effect upon our nervous system. Prof. Berthelot has recently shown, by a careful series of experiments, that sound-waves do not, like thermic and luminous vibrations, set up chemical changes in bodies submitted to their influence; but our inability to give an account of the fact does not affect its existence. We feel that noise is distressing, exhaustive. The strongest man after days spent amidst noise and clatter, longs for relief, though he may not know from what. It may even be suggested that the comparative silence of the sea-side, the country, or the mountains, is the main charm of our summer and autumn holidays, and contributes much more than does ozone to restore a healthy tone to the brains of our wearied men of business. Indeed, if we consider, we shall find that this is the most unnatural feature of modern life. In our cities and commercial towns the ear is never at rest, and is continually conveying to the brain impressions rarely pleasant, still more rarely useful or instructive, but always perturbing, always savouring of unrest. In addition to the indistinct but never-ceasing sea of sound made up of the rolling of vehicles, the hum of voices, and the clatter of feet, there are the more positively annoying and distracting elements, such as German bands, organ-grinders, church-bells, railway-whistles, and the like. In simpler and more primitive times, and to some extent even yet in the country, the normal condition of things is silence, and the auditory nerves are only occasionally excited. It is scarcely to be expected that such a change can be undergone without unpleasant consequences.

The question has been raised, why should some noises interfere with brain-work by day and disturb our rest at night so much more than others? A strange explanation has been proposed. We are told that sounds made incidentally and unintentionally—such as the rolling of wheels, the clatter of machinery (except very close at hand), the sound of footsteps, and, in short, all noises not made for the sake

of noise—distress us little. We may become as completely habituated to them as to the sound of the wind, the rustling of trees, or the murmur of a river. On the other hand, all sounds into which human or animal will enters as a necessary element are in the highest degree distressing. Thus it is, to any ordinary man, impossible to become habituated to the screaming of a child, the barking and yelping of dogs, the strains of a piano, a harmonium, or a fiddle on the other side of a thin party-wall, or the clangour of bells. These noises, the more frequently we hear them, seem to grow more irritating and thought-dispelling.

But whilst admitting a very wide distinction between these two classes of sounds, we must pause before ascribing these differences to the intervention or non-intervention of will. We shall find certain very obvious distinctions between the two kinds of sound. The promiscuous din of movement, voice, and traffic, even in the busiest city, has in it nothing sharp or accentuated; it forms a continuous whole, in which each individual variation is averaged and toned down. The distressing sounds, on the other hand, are often shrill, abrupt, distinctly accentuated and discrete rather than continuous. Take, for instance, the ringing of bells; it is monotonous in the extreme, but it recurs at regular intervals. Hence its action upon the brain is intensified, just as in the march of troops over a suspension-bridge each step increases the vibration. The pain to the listener is the greater because he knows that the shock will come, and awaits it. Very similar is the case with another gratuitous noise, the barking of dogs. Each bark, be it acute or grave, is in the highest degree abrupt, sharply marked, or *staccato*, as we believe a musician would term it. Though the intervals are less regularly marked than in the case of church-bells, we have still a prolonged series of distinct shocks communicated to the brain. Well might Goethe say—

> —— "vor allem
> Ist das Hundegebell mir verhasst;
> Klaffend zerreisst es das Ohr."

All the other more distressing kinds of noise possess the characters of shrillness, loudness, and of recurrent beats or blasts.

As an instance of an undesigned, unintentional noise being distressing to those within ear-shot, we may mention the dripping of water. A single drop, whether penetrating through a defective roof, falling from the arch of a cavern,

or issuing from a leaky pipe, and repeated at regular intervals, is as annoying as the tolling of a bell, the barking of a dog, or the short sharp screams of a fretful infant. The only difference is that the noise is not heard as far. We may hence dismiss the "will" theory, and refer the effects of noises of this class to regularity, accentuation, and sharpness.

It is particularly unfortunate that the multiplication of sound should accompany, almost hand in hand, that increase of nervous irritability and that tendency to cerebral disease which rank among the saddest features of modern life. A people worn out with over-work, worry, and competitive examinations might at least be spared all unnecessary noise. Many persons cannot or will not understand how necessary silence is to the thinker. A friend of the writer's, engaged in investigating certain very abstruse questions in physics, is often compelled to throw aside his work when an organ-grinder enters the street, and suffers from acute pain in the head if he attempts to go on with his researches.

We should therefore propose, as measures of sanitary reform, the absolute prohibition of street-music, which is more rampant in London than in any other capital in Europe. The present law, which throws upon the sufferer the burden of moving in the matter, is a mere mockery. Another necessary point is the abolition of church-bells. In these days of innumerable clocks and watches everyone can tell when it is the time for Divine Service without an entire neighbourhood being disturbed for some twenty minutes at a time. Nonconformist places of worship collect their congregations without this nuisance. Further, all dogs convicted of persistent barking should be disestablished. And lastly, harmoniums, American organs, and wind-instruments in general should be prohibited, except in detached houses.

V. ON THE EVILS OF SECTARIAN MORALITY, CONTRASTED WITH THE BENEFITS OF THE SCIENTIFIC OR NATURAL SYSTEM.

By S. Tolver Preston.

IT has been an idea with some that because the religions of sects have been naturally evolved according to the general theory of Evolution, that therefore they must have been fitting to some extent. It would seem to be overlooked here that error—connected doubtless with an imperfection or infirmity of the brain—is a concomitant to evolution as well as truth; that we cannot expect truth to prevail at once (though there are some recent signs of a rapid advance); and that the real fact may be that society has survived, not through sectarian ethics, but *in spite of it*. I do not allude here to the simple belief in a Supreme Being, against which there would be not one word to be said, but to the endless doctrines and sectarian *propaganda* (unfortunately tacked on to this simple belief), and which are unworthily classed as "religion." It is notorious that the most eminent minds have distrusted to the greatest degree the common idea of the salutary influence of popular religions, more especially the grand old Greek philosophers. It would be arrogant to suppose that we are so near perfection that there is not much to reform yet in doctrines and views; for progress consists in the continued elimination of error. The first step towards the establishment of truth must evidently be the abolition of sects; for truth can, of its very essence, never be sectarian. The foundation of morality upon an unsectarian or universal basis therefore becomes a pressing need. It cannot be doubted that the introduction of the new Morality now being unfolded by Natural Science may be accelerated by showing the conclusion to be well founded that the present sectarian morality, so far from conducing to stability in society, in reality tends to upset it (or constitutes an encouragement to wrong-doing), and that these doctrines have been mainly sheltered from attack by the unfortunate idea of their salutariness.

It is not doubted for one moment that there are a large number of well-meaning people who teach these doctrines with

the best intentions. But unfortunately "well-meaning" people may be unconsciously great harm-producers, since there is nothing more detrimental than misdirected energy. Indifference is preferable. We want more "*well-acting*" people. When we observe, in the recent past, a large number of people devising an elaborate system for strangling trade, and, without even a feeble consciousness of the implied irony, *naïvely* calling the system "protection," we may be inevitably led to suspect that the "protection" of morals by sects may be as much a system for strangling them as in the case of trade; and that the emancipation of morality from sectarian control may be a necessity for the national welfare of the same (but of a far more pressing) kind as the freedom of trade. It is a fact, notorious to any searchers after truth, that often things which when superficially looked at have one aspect, when deeply looked at have just *the reverse* aspect. This I maintain to be the case with the supposed "protection" of morals by sectarian doctrine, or, in other words, a little more than a superficial analysis will show that the present system actually sets a premium on wrong-doing. It would be scarcely reasonable to suppose that the present sectarian leaders (even if competent as a body to do so) should see it to their interests to submit this question to such a searching examination as to jeopardise their own *raison d'être*. This task must be left to the un-sectarian or independent students of Nature who are more concerned with the foundation of universal truths than of sects, but who (regretably) seem not quite to have escaped the contagion of the popular idea that unfounded doctrine can be salutary, or conduce to stability—as if ignorance were not far preferable to error.

While, however, the followers of Science are somewhat reluctant to come forward, under the influence of this idea, the "well-meaning" people are having it all their own way, and, with that overweening confidence invariably characteristic of incapacity, are issuing by tract and volume the literature called "moral" by the cartload,—for home and export,—to an extent not even feebly imitated by any other country in Europe.* It may be a fair question for the independent pioneers of knowledge, how long they intend to incur the responsibility of leaving practically the entire

* Because of the notorious fact that our insular position tends to restrict the immense benefits of the free interchange and conflict of ideas enjoyed by Continental nations, which is the surest safeguard for truth, we ought surely to be all the more careful and suspicious lest any errors may crystallise in our midst. Of course the fact that an error is thought to be good is not a remarkable thing, because that may be the chief reason *why* it is an error (or why it is an evil).

control of morality in the hands of interested sects. Signs are not wanting now that it is high time for Science to speak out boldly, and not be afraid of holding the mirror up to fallacies, whatever their nature. It may be a reasonable inquiry whether the dread of Science is not a great arrogance—just as if people constituted themselves self-appointed judges of what *ought* to be truth.

Strange as it may seem, it is none the less unquestionably true that a popular idea widely prevails that, by giving the name "religion" to certain doctrines, they become thereby privileged, or exempt from reasonable or independent criticism,—that these doctrines are not fit for Science to deal with. It must be admitted (as perfectly self-evident) that, if this contention were valid, there would be nothing to prevent giving the name "religion" to what might prove unconsciously to be the most destructive and pernicious errors which ever afflicted mankind, and thereby enthroning them as for ever exempt from the penetrating gaze of reason and of truth. We may perhaps recognise here without difficulty one cause for the indiscriminate use (or rather abuse) of the term "religion," as now applied to all kinds of doctrines. They become thereby "protected" as sacred,—just as if truth needed sanctification, or were incapable of standing on its own merits. It is certain that if a system wants a foundation, neither sanctimonious language, music, nor ceremonial will supply it, though unfortunately these may act with greater force upon inexperienced minds than proof itself. Even the noble science of music may admit of being perverted to a wrong purpose. It must not be a matter for surprise, therefore, that when (after the long period of protection) the system is thrown under a rigid analysis, some startling incongruities may disclose themselves.

My object will be to demonstrate the two following propositions, which are selected as primary ones of such a definite character as to avoid any possibility of entanglement:—The first proposition is, that the *effect* (discarding motives so as to ensure certainty) of the morality propagated by sects is invariably to secure the *domination** of the leader of the sect (or his emissaries). The second proposition is, that the conditions for determining this end must unavoidably (from a necessary property inherent in the conditions themselves, and apart from motives) be of such a character as to set a premium on wrong-doing. In order to make this quite clear, it will be desirable to recapitulate briefly one or two points contained in a foot-note (page 450)

* This first proposition has already been ably considered in some points by others.

in the former paper on "Natural Science and Morality" ("Journal of Science," July, 1880).

It will be observed, on analysing the subject, that in principle the plan invariably adopted in the formation of sects is to attempt to enchain the interests of mankind as powerfully as possible by asserting the existence of some great danger or overhanging calamity, to magnify which adequately no range or license is set. Thus, for instance, the asserted danger may be *eternal* punishment (in which case it may be observed that the range is made *infinite*, or the danger is magnified without limit). To act upon the conceptions various similes are then used, of as terrifying a character as may be, by selecting well-known agencies which produce the most intense physical pain. [It is apparently forgotten that an infinite—or everlasting—punishment necessarily implies an *infinite* insult to a just Deity; the magnitude of the insult being, mathematically estimated, in direct proportion to the magnitude of the violation of justice incurred.] After taking this primary step, the next procedure is to suggest a remedy or means of escape from the asserted danger, coupled with a certain amount of spurious mystery, as this (as a well-known fact) tells most with the ignorant class. The unfortunate man whose terrors have been worked upon by the varied images used to pourtray the nature of the punishment then looks upon the leader of the sect (or his emissary), who instructs him as to the means of escape, in the light of a benefactor and preserver. Certain conditions are then stated to be contingent on being saved from the asserted future punishment, the most important one being implicit and unquestioning belief in all the statements of the leader of the sect (the validity of which are to be "justified by faith"—which latter quality, so far from being reprobated, is extolled as the highest virtue); together with absolute subjection to whatever course of conduct the leader of the sect (or his emissary) may please to command. Here we have the achievement of *domination*.*

* It would surely be an insult to the general public to make them as a body responsible for the *propaganda* of the originators of sects, or to indulge the dream for one moment that such monstrosities of doctrine could ever have had their origin in unbiassed persons, whose sole aim was the attainment of truth, in harmony with right and justice, and apart from personal ideas of ambition and self-advancement.

Precisely because such *propaganda* have been protected by the absurdity of calling them "religion," and by the (if possible) greater absurdity of supposing them beneficial to society, so may they be expected, when this spurious shield is removed, to crumble to pieces at the touch of a scientific analysis. The full amount of unhappiness caused in the world by the originators of such doctrines will only be adequately guaged by the science of the future. For just as the

In regard to our second proposition, viz., the premium *necessarily* set on wrong-doing by the above system,—independently of any motive to do so, but inherent in the system itself,—we may observe. first, that the fundamental principle involved here is that the escape from a certain imminent danger (such as a punishment of unlimited magnitude) is made contingent on certain *conduct*. The man appealed to therefore infallibly reasons that if the asserted danger be a myth, then such prohibited conduct must be in itself extremely desirable and profitable; for he argues that it would be transparently absurd to hold out an enormous (infinite) punishment as a deterrent, unless the course of conduct itself were exceptionally attractive or conducive to profit. If, therefore, his belief in the asserted punishment in a future world is very shadowy (as is actually the case with the majority of mankind), he may be naturally induced to follow crime and vice in the belief that (in escaping the enormous future punishment) they must be extremely conducive to present interests. So far therefore from being taught that crime is unprofitable *in itself* (or brings its own punishment with it), he is in effect led to infer the exact opposite. Thus the highest premium (in fact by implication infinite) is set on wrong-doing by this doctrine, and, conversely, a deterrent set on virtue, which is made to appear opposed to present interests. For it may be justly argued (in an analogous way) that if an infinite reward in a future world be necessary for right conduct, then such conduct must be connected with great hardship and privation in this

advance of knowledge is sure to exhibit in a clearer light the happiness caused by the friends of science, so it will show more plainly the misery caused by its opponents; and it is inevitable that in the purer intellectual atmosphere of the future the condemnation of these sectarian *propaganda* will be far more emphatic than has ever been penned yet. For the growing appreciation of the benefits of truth must unavoidably run parallel to that of the evils of error. It is a significant fact that those who opposed these *propaganda* most bravely in the past are becoming more and more recognised as the true champions of the happiness of mankind, as time advances. The severest judgment the public could pronounce on themselves would lie in their failure to appreciate the services of men who took so signal a part in the battle against fanaticism and superstition, one of the chief sources of human misery. To speak of the "conflict between religion and science" is to speak of ignominious defeat, or to degrade "religion" to doctrines unworthy of the name. The defunct Hebrew cosmogony once classed as "religion" may picture the fate of the Hebrew ethics of threats and promises. It may be superfluous to lay stress on the perfectly well-known fact that promises and threats have (all the world over) been the most commonplace devices adopted to influence mankind; the only peculiarity here being that both the threats and the promises are magnified absolutely without limit, as if to strain the credulity of mankind beyond bounds.

life. In fact the sectarian morality, when looked at a little below the surface, shows itself to be the *exact antithesis* of the scientific morality, founded on the study of Nature, which teaches that the path of virtue (or right conduct) actually coincides with that of self-interest, or present welfare, and that the path of vice is directly opposed thereto,—thus affording the most natural and healthy motive to right conduct conceivable, and an equally forcible deterrent against wrong conduct. If, therefore, there be grounds for concluding that the scientific morality is good or beneficial, it must follow with equal necessity that the sectarian morality (as its antithesis) must be detrimental to a corresponding degree. In fact the one *leads* mankind by enlisting his present interest on the side of virtue, the other attempts to coerce him by a low and degrading system of terrorism, which (like all such attempts) must inevitably recoil upon itself, and have the exact opposite effect to that intended.

This may perhaps form a not un-noteworthy instance of the fallacy of the idea of the salutariness of error,—so often warned against by a few eminent minds before, who have incurred *odium* on that account, but who have nevertheless boldly asserted that error never can do good, and never can conduce to stability in society, but brings the positive harm inseparable from error. If a man is left in crass ignorance he has some chance, for he can inquire for himself; but when his brain is poisoned* (especially when young and extremely sensitive to first impressions) by the fearful doctrines of sects, he may be hopelessly ruined for life,—as has unquestionably occurred in many cases† under the wholesale

* The poisoning is here literal; for it is a well-known fact that every sentence uttered physically affects the brain, and when reiterated may leave its permanent impress there.

† *Post-scriptum.*—I look back with an indignation difficult to repress at what was taught me when young [*i.e.*, at the system], and which almost proved my ruin, leaving its detrimental traces to the present day. I am led to mention this in the hope of benefitting others—as one of a class who perhaps rarely pass through their experiences with strength of mind left to analyse the system which produced their undeserved grievances. If error be not an evil, or if fallacies cannot cause injury, then what can?—and errors of absolutely unlimited magnitude. Some people, however, appear to have so restricted powers of realisation that they can actually profess to believe such fallacies without the faintest conception of their import. Their inconsistencies are absolutely terrible (even if unconscious). They can protest the Deity is a God of Love one moment, and ascribe the boundless Hate involved in an *eternal* punishment the next. It apparently could not be of much consequence what was taught in their case. Life can only be extinguished with the greatest effect when it burns most brilliantly. The most sensitive children—those whose inquiring minds are readiest to appreciate the truth—are those who are most effectually strangled by fallacies of enormous magnitude. Let it not be supposed that there is exaggeration here. An intellect of high sensibility, while it will be

system of instilling the terrifying propaganda of half-civilised Palestine into the fresh intellects of children of the nineteenth century (aided by solemn music and ceremonial*),

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beneficially affected to an exceptional degree by the inculcation of truth, cannot fail (unfortunately) to be injuriously affected to a corresponding degree by the infusion of error. The greatest cruelty is to teach a child an untruth; the disastrous effect is not lessened by its being unintentional. And when the fallacies are numerous, of unlimited scope, and imprinted on the brain with the greatest solemnity and ceremonial, the effect is necessarily proportional thereto. The child rendered melancholy (in proportion to his intellectual powers of realisation) by the perpetual oppression of monstrous and supernatural beliefs, which disintegrate the mind, and cut off from the opinions of the intellectual few, naturally judges of the world by his surroundings. Finding no sympathy, and believing himself isolated in his opposition to these doctrines, the suspicion of madness may at last present itself, the more he reflects and tries to reconcile the impossible. And this may be the end finally attained (as is known to have occurred in many cases) under the utterly reckless system that prevails. The miserable excuse of benefiting (!) society by the system has been urged in palliation, just as if it required an array of argument to prove that error must inevitably do harm to the whole bulk of society which it affects.

* It was remarked, on the occasion of a recent change of political rulers, that a certain proclivity existed towards the adoration of the alphabet, such that "a square inch of title was sometimes balanced against a square acre of brains" (in influencing choice). If this be true, can we wonder that a vestment, combined with a sanctimonious tone, should often have more effect than plain and unadorned logic, and should even be capable of going far to supply a deficient foundation of fact. Such is the limitless absurdity of the habits of thought capable of being drilled into the brain in childhood (and strengthened by the principle of inheritance through generations), against which reason may protest in vain.

A passing reflection may even possibly not be wasted on the fact that the irresponsible representatives of the alphabet domineer (in a special House) over the elected representatives of the nation—a state of things which it will be admitted (as palpably self-evident) no one in his sober senses would ever have dreamt of *originating* in the present day. It is simply a case of habit or custom transmitted down to us, and kept up by modes of thought inculcated in early infancy, the custom itself having been *originated* by persons of whom it may at least be said that they stood somewhat nearer to their probable Simian progenitors than we do. So difficult is it to uproot a custom or a traditional belief when once it is set; and this fact is one of general application. The fallacy resembles in some respects a bodily infirmity, transmissible (or affected in some degree) by inheritance, being no doubt connected with a defect—or possibly torpid state—of the brain, which, like any other part of the organisation, is known to be subject to the laws of descent. It is true that a particular brain process termed "reasoning" (when persistently and actively entered upon) can obliterate the defect representing (say) an unfounded sectarian belief of long standing, and the physical effect of a paragraph of plain logic on a brain may be like that of a scalpel on any other part of the organisation—in regard to the temporary pain caused and the permanent benefit secured. Thus, by a single beneficial surgical operation of this kind, an error or unfounded belief transmitted for centuries may sometimes be eradicated. While the accumulation of error is in general slow, its destruction may be fortunately rapid. It may occupy but a short time to remove a tumour which has taken perhaps centuries to develop. A single great and original work [of course fitly received by a scream of opposition at first, since antagonism to set habits of thought is the principal value of originality] has been known to change the character of a nation within a relatively short period; as nations, it is said, are moulded by their greatest minds (of which their character bears the

and the vast quantity of dangerous literature relating thereto, which is sometimes almost forced into households by a special machinery, against their wills, kept alive in great part by the posthumous endowments of "well-meaning" and wealthy old ladies,* who are fed on the same literature, and whose minds have been so drugged by the process that their complete incapacity to appreciate the pure truths of

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indelible impress). Not the least benefit conferred by the enormous power of knowledge acquired through the unfolding of the principle of Evolution will be, no doubt, the capacity it gives us to trace and nail error. The problem of the Evolution of Error will probably form a most instructive one for the future. in connection with the general theory of Evolution. Perhaps the greatest service that could be rendered to the rising generation would be the purely passive one of abstaining from teaching them error, leaving them a little more to their own ideas and natural resources. It might be a curious imaginative *à priori* problem to consider how far a generation would advance if all the books except those relating to demonstrated truths were burnt. It would not probably take them long to create a sufficient amount of fiction and speculative theories to amuse themselves with, which it would certainly not occur to them to teach to the succeeding generation as *truths* (as unscrupulous barbarians in the past might well be conceived to have done). The probability of would-be originators of sects obtaining a hearing would be (to say the least) extremely remote under the high intellectual *status* existing. Universal truth alone would be permitted to reign. This purely imaginary case would simply represent a step taken towards *cutting the link of error* which binds mankind to the barbarous past, and which (when unsevered) transmits by inheritance the interminable series of fictions inevitably attendant on evolution from a lower state to a higher—fictions which we should no more have dreamed of inventing ourselves than we should think now of turning to primæval clothing. It seems astonishing how little we distrust legacies bequeathed to us from a remote antiquity. We appear to forget that semi-barbarous races might not have been so particular about lying as we should be. One valuable feature of the doctrine of Evolution is the wholesome distrust it inspires for anything remotely ancient, and the corresponding lively hope it affords for the future. The doctrine breathes the very spirit of reform and liberalism. It is a common propensity of superficial people to have an intense reverence for the "damnably good old times" (as the late Charles Dickens called them).

* The system is worked (as is known) in this country by societies, receiving large funds out of the superfluous wealth characteristic of the nation—an evidently unhealthy system with the best intentions. For while scientific truth is mainly diffused by brain, these "moral" truths (!) [Heaven save the mark] seem to be mainly diffused by money. We might enlarge upon the evils of a sectarian system of Hebrew ethics which gives such an extraordinary prominence to alms-giving, setting it up indeed as the highest ideal of virtue (the practical carrying out of the text which makes the test of *perfection* the selling of all one's goods and giving the proceeds to the poor). The origin of our abnormal Poor Law, which has no parallel in Europe for its evils, may be naturally traced here. To inquire into the causes of the thriftlessness and improvidence which are so notorious in this country would be a burlesque in view of these facts. The huge list of alms-giving societies is culminated (as if in irony) by one whose special function appears to be to "organise" the disorganisation. The many excellences of the country are too notorious for it to fear its faults being pointed out; indeed these appear all the more glaring by contrast. The national character seems to be made up of some curious contrasts and anomalies (naturally due, no doubt, to evolution in an *insular* position), and which may form a most fertile and interesting field for study.

Nature is only paralleled by their insensibility to errors of inconceivable magnitude (involving the most cruel violations of justice). If it were not for the fortunate fact that such literature (all founded on the ethics of terrorism of the barbarous Hebrew) fails to take root in the minds of the majority, the evil would be colossal.* As it is, the intelligent minority (or the young of exceptionally inquiring minds) are those most liable to be caught here. The known violent antagonism of the writers of such doctrines to demonstrated scientific truth, itself proves the magnitude of the error. The development of this species of literature has proceeded in a groove (a known characteristic of evolution) until it has attained gigantic proportions, forming a special feature unapproached by any other civilised country. Its complete collapse—together with the barbarous system of Hebrew ethics which it represents—will illustrate the fortunate property of error to defeat itself by its own growth, until it becomes a forgotten feature in the ever-advancing tide of progress. Unfortunately this tendency to forget the evils of the past, and the fearful state of religious fanaticism which once existed, by which progress and healthy life were strangled, makes mankind oblivious of the benefits conferred by those who fought against error in spite of popular prejudice, and through which conflict alone the present blessings of national prosperity and freedom have been won. Will it be supposed, however, for one moment that perfection is so nearly reached that more victories of the same kind have not yet to be achieved? The new morality can only advance in triumph over the ruins of the old.

* If it be supposed for a moment that people whose antipathy to demonstrated scientific truth is notorious, can be active to the extent they are in the propagation of their ideas without doing harm, then one may be inclined to ask, What on earth could constitute an evil? The ideas of some are so antithetical to natural truths that blame from them constitutes eulogy. What, for instance, could have been a more consistent eulogy of the great work of the French philosopher, Helvetius, than its denunciation by the Jesuits as an "*œuvre satanique*." It is not denied that there may be some earnest people even among the Jesuits. But incapacity may be as fatal to the welfare of mankind as open hostility to right and justice. Having given in this essay every credit to good intentions, there is less reason for blinking the plain facts, which must be realised in the interests of truth. Nothing is more certain than that this world is not yet perfect; that errors tend to gravitate into fixed habits, the temporary pain caused in the eradication of which must be proportional to the permanent benefit secured; and that future progress will certainly increase rather than diminish the estimate of past error.

ANALYSES OF BOOKS.

*Gesammelte Kleinere Schriften Naturwissenschaftlichen Inhalts.** Von CHARLES MARTINS. Autorisirte Uebersetzung von STEPHAN BORN. 1 Band. Basel: Schweighauserische Verlag's buchhandlung (Hugo Richter).

THE name of Charles Martins is so widely and so honourably known that we shall not need to enter into any explanations on introducing the German edition of his collected works to the notice of our readers.

Of the six essays included in the present volume, three may be considered of more temporary interest, and as dealing with subjects sufficiently well known to the thoughtful and cultivated portion of the English public.

The article on the "British Association for the Promotion of Science" was written in order to promote the formation of a similar body in France, and in this respect the labours of the author and of his friends have been crowned with success. A "French Association," essentially on the same principle, has been constituted, and is apparently running a course of increasing utility. We must not, however, forget that the German "Association of Naturalists and Physicians," called into existence by the illustrious Oken, was the earliest society of this nature.

An account of the origin and constitution of the British Association, and of the proceedings at one of its annual gatherings, needs of course little notice in a country where both the light and the shadow side of this itinerant Academy are thoroughly well known. But we feel bound to acknowledge the accuracy and fairness of Prof. Martins's descriptions. It is sometimes said that no Frenchman ever succeeds in fully understanding anything English. To this rule, if rule it be, the author is an exception. We find here no mistakes which may rank higher than clerical errors.

Another memoir is devoted to the exploring voyage of the *Challenger*—a subject in itself of unquestionable interest, but too well known to require special analysis, though it is introduced by a brief historical survey of earlier scientific expeditions, among which due attention is paid to the ever-memorable voyage of the *Beagle*. The author laments that the medical officers of the French navy are rarely qualified by their previous training to become successful observers in any department of science.

* The Collected Minor Works of Charles Martins on Subjects connected with the Natural Sciences.

A third essay discusses the possibility of reaching the North Pole, and the causes of the failure of former attempts.

The three treatises which make up the first portion of the volume are of a wider and a more permanent interest. They are devoted to the "Theory of Evolution—the Value and Correspondence of the Evidence upon which it is founded;" "Lamarck, his Life and Works;" and "Floras, their Origin, Composition, and Migrations."

In reading these essays we feel ourselves in the society of a philosophical naturalist of high order. He declares that "the theory of Evolution made known by Lamarck in 1809, philosophically comprehended by Goethe, definitely constituted by Charles Darwin and developed by his pupils, links together all the parts of natural history just as the researches of Newton harmonised the movements of the heavenly bodies. It is, indeed, closely connected with the transformation of the physical forces." Here we miss the recognition of Erasmus Darwin, who certainly was not an imitator of Lamarck, and who yet came very near anticipating his illustrious grandson. The object of Professor Martins, in the treatise before us, is to show that the Evolutionist theory possesses all the characteristics of the Newtonian laws, and that like them it rests upon a daily accumulating mass of evidence. To this end he first expounds the continuity of creation and the phenomena of atavism. If each zoological epoch terminated, according to the catastrophists, in some convulsion of nature which made a clean sweep of all animal and vegetable life, how is it that plants which existed in the Tertiary period,—such as the pomegranate, the Judas tree, the oleander, the gincko, &c.,—though extirpated in their old haunts by reason of climatic alterations, still survive in warmer regions? Hence we see that the flora of to-day is a continuation of the flora of the past, the forms being either identical or somewhat modified. The gincko has the leaves of a fern, the stem of a Conifer, the catkin male blossoms of the Amentaceæ (poplar, birch, &c.), and the naked seeds of a Cycad. These facts indicate that the ferns are the common ancestors of the gincko and of the Cycads.

In like manner the living fauna is the uninterrupted continuation of the fossil fauna. The animals which move and multiply around us are descendants of the beings whose skeletons or cases have rested for unnumbered ages in the rocks. As instances the author mentions the modern elephant, rhinoceros, tapir, &c., so little modified from their ancestors, and which therefore seem almost out of place among forms which have changed so rapidly as the deer, the antelope, and especially the horse. He points out that numbers of extinct species hold, as it were, intermediate positions, and form "missing links" between living groups whose characters they combine.

The phenomena of atavism are no less striking among animals than among plants. Numerous forms display the atrophied and

now useless rudiments of parts or organs which in their forefathers exercised some important function. Thus the rudimental breasts of the human male are a far-off reminiscence of the hermaphroditism which we meet in many lower animals; the pyramidal muscles, a remnant of those which close the pouch of the marsupials. The cœcum is another obsolescent organ which in man, so far from being of any use, affords merely the possibility of a painful death. There are more than twenty authentic cases on record where the entrance of a grain of sand, a grape-stone, &c., into this appendage has occasioned fatal peritonitis.

Prof. Martins does not omit to rebuke the unqualified writers who impute to Darwin the assertion that man is descended from the gorilla or the chimpanzee.

A second section is devoted to the transitions between organic beings, and to the non-existence of species as natural objective realities. As a prolific hybrid he mentions *Ægilops triticoides*, a cross between wheat and *Ægilops ovata*, often found in the South of France.

In the third section the author gives a survey of the embryological proofs. He concludes with a passage which we feel bound to transcribe:—"The principle of Evolution is not confined to organic beings; it is a universal principle, governing all things which have a beginning, a progressive duration, an inevitable decline, and a prospective end. The application of this principle is ordained to facilitate the progress of all science, and to throw a new light upon the history of humanity: the solar system, the earth, organic beings, the human race, civilisation, nations, languages, religions, social and political order,—everything obeys the law of Evolution. Nothing is created,* everything is transformed. Solomon probably knew this when he exclaimed 'Nothing new under the sun!' The evolution of living nature is the type and the pattern for everything which advances in the physical as well as in the spiritual and moral world." This is admirably expressed. But does not the author, when he formally proclaims immobility and a definite retrogression impossibilities, forget that the organic world affords instances of both, as has been well shown by Dr. Dohrn and Prof. Ray Lankester?† Degeneration, degradation may be traced in animal and vegetable life, in the history of language, and in social science.

The essay on the life and works of Lamarck scarcely brings out with sufficient distinctness his connection with Buffon. It contains one most painful passage. On his death in 1829, at the age of 85, his two daughters were left without resources:—"I myself saw, in 1832, Miss Cornélie de Lamarck, for a paltry remuneration, engaged in fixing upon white paper the plants in the herbarium of the establishment where their father had been

* That is, no new element is flung, as it were, catastrophically among what already exists.

† *See* Journal of Science, July, 1880, p. 465.

Professor. If they had been the daughters of a minister or a general the two sisters would probably have received a pension; but their father was merely a great naturalist, and an honour to his country for all time."

Prof. Martins gives an exposition of the "Philosophie Zoologique" of Lamarck, showing how he approximates to the evolutionist writers of our day, and where he falls short of them for want of a knowledge of facts which have only been discovered since his death. The well-known argument of Cuvier for the permanence of species, founded on the identity of mummified animals with their still living descendants, is shown to prove too much. If of any weight at all, it would equally demonstrate the permanence and independent origin of races, breeds, and varieties. The ram depicted on Egyptian monuments is identical with the ram of Modern Nubia; the small horse of the Lithuanian peasantry is the same whose skeleton is found in ancient tumuli. What, then, must we think of such writers as Dr. Bateman, who, in the face of such facts, refurbish this Cuvierian fallacy?* Mention is made of an anatomical peculiarity of man, the posterior opening of the sacrum which under certain cases imperils the lives of great numbers of persons.† Lamarck was fully aware that species, in the sense applied to to the term by Linnæus and Cuvier, do not exist. He admitted so-called "spontaneous generation," *i.e.*, the production of the lowest organisms from inorganic matter. But we shall do well to note that he ascribes the development not to chance or necessity, but to the will of the Creator of all things.‡ This agrees closely with the view of Lavoisier,‖ that "God, when He created light diffused over the earth the principle of organisation and of sensibility." Hence the theory of Lamarck on the origin of life, so far from being atheistic, agrees essentially with that asserted by orthodox Christians!

Space unfortunately does not allow us to enter into the interesting chapter on Lamark's psychology. In reference to the charge of Materialism raised against the great French naturalist, our author remarks:—"Materialism, spiritualism are meaningless words, which it is time to banish from the strict language of Science. What is matter? It is impossible to define. What is spirit? Another unanswerable riddle? These words, which serve as the starting-points of antagonistic doctrines, produce vain discussions which can lead to no result."

It may perhaps be argued, in some quarters, that such essays as these which Prof. Martins has produced are no longer necessary. We do not accept this contention. So long as the Evolutionist doctrine is persistently misunderstood and mis-

* Journal of Science, December, 1879, p. 804. See also March, 1880, p. 166.
† Broca, Rev. Anthropologique, t. 1, p. 596.
‡ Philosophie Zoologique, i., p. 74, and ii., p. 57.
‖ Traité de Chimie, i., p. 202.

interpreted, not merely by the jealousy and pseudo-conservatism of the old, but also by the rashness and sciolism of the young expositions of its evidences, its true character and its tendencies will be needed.

The German translator has performed his task ably and thoroughly.

A Treatise on Comparative Embryology. By F. M. BALFOUR, F.R.S. In two volumes. Vol. I. London: Macmillan and Co.

WE have here a complete and systematic treatise on one of the most important branches of Biology. Since the evolutionist theory of the organic world has become the accepted view of the majority of minds capable of judging, Embryology has undergone a remarkable increase in its interest and in the importance of its revelations. The resemblance of the embryonic and larval stages of the higher animals to the lower forms of their respective groups had long excited the attention of philosophical zoologists, and is now recognised as supplying a most valuable body of evidence in favour of the so-called doctrine of Descent, and against that of mechanical or contract Creation. For want, however, of such knowledge as the work before us will furnish, this parallelism between the evolution of the individual and of the group, if not overstrained, has been somewhat distorted. The higher embryo does not exactly resemble the lower adult. Nor would such close resemblance, if it existed, be in harmony with the requirements of the modern theory, which regards all organic groups as formed by a series of branchings out from one common stem. The human embryo, at a certain stage of growth, approximates very closely to those of apes, and even of carnivorous animals. But as the species approach maturity they diverge more and more from each other, so that the child has never passed through a stage resembling that of the mias or the dog. What really does occur, as stated by the author, is this:—"Each organism reproduces the variations inherited from all its ancestors at successive stages in its individual ontogeny, which correspond with those stages at which such variations appeared in its ancestors;" and to the law, as thus stated, we do not see that any exception need be taken.

But whilst the enhanced importance of embryology and the abundance of researches lately undertaken render a work like that before us desirable, they place, as the author fully recognises, serious difficulties in the way of its execution. He refers to the recent appearance of "a large number of incomplete and contradictory observations and theories." He might have mentioned that some of these researches have been undertaken by men

whose motives are open to question. If a biologist enters upon investigations not with a view to the discovery of the simple truth, but in the hope of meeting with facts irreconcilable with organic evolution, we are justified in regarding his results with suspicion. Nor is it certain that a contrary bias, in favour of the doctrine of Descent, may not in other cases have been present. Hence, as Prof. Balfour admits, it may be considered doubtful whether the time has yet come for all these observations to harmonise and arrange in a coherent whole. Still we think our readers will agree with us that he merits the thanks of biologists for the manner in which he has executed this difficult task. The literature of the subject, scattered through the scientific journals and the Transactions of learned societies, is of prodigious extent, as an examination of the bibliographical appendix will show. It conveys, at the same time, the unpleasant reflection how small a portion of the researches in this field has been executed by Englishmen.

The present work is devoted solely to the embryology of those animals now characterised as "metazoa," and the subject is treated from a morphological rather than from a physiological point of view. The objects of Embryology are shown to be twofold—to form a basis for phylogeny, the history of the development of the group, and for organogeny, the doctrine of the origin and evolution of organs. Among the subjects specially discussed in the former department are the questions how far embryology brings to light ancestral forms common to all metazoa? how far some special embryonic larval form is constantly reproduced in the ontogeny of the members of one or of more groups of the animal kingdom, and how far such larval forms may be understood as the ancestral type of such groups? how far such forms agree with adult forms, living or fossil? how far organs appear in the embryo or larva which in the adult state are either atrophied or lose their functions, but which persist permanently in members of other groups or in lower members of the same group? and how far organs in the course of their development pass through a condition permanent in some lower form? The author justly remarks that the solution of these problems would be greatly simplified if each organism contained in itself the full record of its origin. But the law which we have quoted above admits of what to the unscientific observer seem exceptions. It is, in other words, merely a statement of what would occur were it the only influence under which organic development takes place. In actual life there are a number of interfering conditions. "The embryological record is almost always more or less abridged in accordance with the tendency of Nature (explicable on the principle of the survival of the fittest) to attain given ends by the easiest means." Secondary structural features are introduced to adapt the larva or embryo for special conditions of its existence, and the problems involved are thus rendered exceedingly complicated.

The organogenic questions to be elucidated by embryology relate to the origin and homologues of the germinal layers, the origin of the primary tissues, and the origin and gradual evolution of the organs and systems of organs.

In expressing our general approval of Prof. Balfour's work we do not wish to be misunderstood. It is by no means a popular treatise. It contains no novel or striking generalisations, and to readers unacquainted with morphological zoology it will prove scarcely intelligible. But to the student and the professed biologist it may be recommended as affording a fair and comprehensive survey of the results hitherto reached in embryology, such as no other work in the language is calculated to afford. The illustrations are numerous and carefully executed, and the references to original memoirs accompanying the chapters and sections are ample. A second volume will treat of vertebrate animals, and with the special histories of the different organs.

The chief defect of the work is one which it shares with no small proportion of modern English biological works,—that is, the tendency to multiply technical terms of Greek origin. We see no good reason why we might not, like the Germans, employ technical terms of native origin. The days are passing away when every man of science may be assumed to be a classical scholar.

Practical Chemistry. The Principles of Qualitative Analysis. By W. A. Tilden, D.Sc., F.C.S. London: Longmans and Co.

The author tells us in his Preface that his book is intended for beginners, and that its production was prompted by the requirements of his own teaching, and "by the consideration that it is not necessary to learn the properties of any large number of substances in order to be in a position to understand the principles of chemical analysis." All this is perfectly true: but among the elementary works on chemistry which have been produced in such astonishing plenty during the last ten years, are there not several—to use the mildest expression—in which the consideration of the rarer elementary bodies is omitted on precisely the same grounds? It cannot be expected that a chemist of Dr. Tilden's standing would be guilty of any error in compiling a book of this simple character, but we can scarcely see any *locus standi* for his work. Pending the avatar of some capital discovery which may essentially modify the outlines of the science, we think that there is no more need for the appearance of any further elementary treatises on chemistry.

Papers and Proceedings and Report of the Royal Society of Tasmania for 1878. Hobart Town: Mercury Office.

THE work done by the Royal Society of Tasmania, if not very great of quantity, is of a sound, satisfactory character. The papers here reproduced deal with questions which can only be investigated on the spot.

Mr. R. M. Johnston contributes a valuable paper on the fresh-water shells of Tasmania. He has discovered one species belonging to a rare genus at present confined to Cuba, but he prudently declines theorising on this fact till our knowledge of the Mollusca of Tasmania and of the Australian mainland is more complete. As regards the distribution of fresh-water shells, he shows how the smaller species may easily be transported to vast distances by the agency of water-beetles and aquatic birds.

Dr. Morton Allport communicates some remarks on the habits of the *Platypus*. He finds that it feeds on caddis grubs, but suspects that it may likewise devour the ova of fish.

The Rev. J. E. Tenison-Woods continues his memoirs on the marine shells of the Tasmanian waters.

Mr. R. M. Johnston has studied the Tertiary and Post-tertiary deposits of the islands in Bass's Straits. He considers that an extensive upheaval of the ocean floor in the districts of South Australia and Tasmania has taken place, and has continued to a very recent period, if it be not still going on. Local encroachments of the sea may be in perfect harmony with a slow vertical movement of the land upwards. He considers that the evidences of Australian geology are in perfect harmony with the theory of Evolution.

The Bishop of Tasmania read a paper on "Water-supply in relation to Disease," full of forcible warning to the community.

We beg to congratulate the Society on the work it is doing, and hope it will persevere in the same direction. The scope for its exertions is practically boundless.

A Practical Treatise on Sea-Sickness: its Symptoms, Nature, and Treatment. By G. M. BEARD, M.D. New York: E. B. Treat.

DR. BEARD takes here a new departure by regarding sea-sickness not as a mere disease of the stomach and liver, to be subdued by "capsicum, calomel, and champagne," &c., but a functional disease of the nervous centres. He utterly scouts the prevailing notion that the affection is in the long run beneficial to the system. He shows that the evil effects do not invariably cease

when the sufferer arrives on land, but may remain for years. Even death is not entirely out of the question. The matter being so much more serious than it is vulgarly supposed to be, it is fortunate that a trustworthy remedy exists. Sodium bromide, or, in default, the corresponding potassium, ammonium, or calcium salts, given three times a day in large doses,—say thirty, sixty, or even ninety grains,—rarely fails to prevent the attack. Dr. F. D. Lente first proposed the use of this salt some three or four days before starting on a voyage, keeping it up until there is reason to believe that all danger is over. Failure is generally the result of too small doses, or of waiting till sea-sickness actually appears before the remedy is given. If vomiting has actually set in, the bromides, and indeed all medicines administered by the mouth, are useless, for the very sufficient reason that they are not retained in the stomach long enough for absorption. In such cases the author recommends the hypodermic injection of atropia—an operation which must, of course, be entrusted only to professional hands.

We hope that Dr. Beard's work will be widely circulated among the medical profession, as it will doubtless prove the means of dispensing with much needless misery.

The First Types and the Serial Succession of Insects in the Palæozoic Epoch.

THE well-known American naturalist, Mr. S. H. Scudder, has published, in the "Archives des Sciences Physiques et Naturelles," a summary of the occurrence of insects in the earlier geological periods. He concludes that, with the exception of certain wings of Hexapods, found in the Devonian strata, all the three groups of insects—the Hexapods, the Arachnides, and the Myriapods—make their appearance simultaneously in the Carboniferous system. The Hexapods, or true insects, may be divided into two classes—the higher (Metabola) comprising the Hymenoptera, Lepidoptera, and Diptera; and the lower (Heterometabola) including the Coleoptera, Hemiptera, Orthoptera, and Neuroptera.

All the insects of the Devonian and the Carboniferous formations are Hetero-metabola, the Metabola making their first appearance in the Jurassic period. In the Palæozoic ages there occur numerous synthetic or generalised types, which combine the characters either of all the Hetero-metabola, or of the Orthoptera and Neuroptera, or of the true Neuroptera and the Pseudo-Neuroptera. The Devonian insects belong to types related to the two lower orders only, or they are Pseudo-Neuroptera with a lower organisation, which unquestionably inhabited the

water during the earlier stages of their existence. The lower orders of the Hetero-metabola, the Orthoptera and Neuroptera, were much more numerous during the Palæozoic period than the higher orders, the Coleoptera and Hemiptera. Almost all the Palæozoic Orthoptera belong to the non-saltatorial families; they are Blattidæ, of low organisation. The true Neuroptera were also in those times far less numerous than the Pseudo-Neuroptera, whose organisation is less perfect. The general type of the structure of the wings of insects has remained the same since the remotest times. Excepting two Coleopterous and one Orthopterous species, it may be maintained that the anterior wings of Palæozoic insects were similar to the posterior or membranaceous pair; a difference only appears in the Mesozoic period. The venation in types of insects otherwise distinct was more uniform than it is at present. The Devonian, and even the Silurian, will probably be found to contain the remains of insects of a type still more generalised than has yet occurred in the Palæozoic strata. Most of the primeval insects were large, and many of them gigantic, and the American and European forms are strikingly similar.

The Food of Birds. By Prof. S. A. Forbes. ("Transactions of the Illinois State Horticultural Society.")

This memoir, which is abstracted and commented upon in that most ably-conducted journal the "American Naturalist," bears so forcibly upon a subject to which we called the attention of our readers in our April number that we feel bound to give it our consideration.

The utility of the small birds to mankind, in America certainly, and probably in England also, is far greater than we imagined. In Illinois there are estimated to be, during the summer half-year, three birds to an acre. The author considers that at least two-thirds of the food of birds consists of insects, and that this insect-food will average at the lowest reasonable estimate twenty insects or insects' eggs daily for each individual of these two-thirds, giving a yearly total of 7200 specimens per acre, or, for the State of Illinois, 250,000,000,000, a number which, placed one to each square inch of surface, would cover 40,000 acres. A careful estimate of the average number of insects per square yard, in this State, gives at the outside 10,000 per acre. Here we may remark that anything like exactitude is difficult. In seasons and districts where aphides, midges, sand-flies, &c., are abundant, this estimate seems to us too low.

To return: if the operations of the birds were suspended, the increase of the insects would be accelerated by about 70 per

cent, and their number, instead of remaining at the present yearly average, would be increased each year by more than two-thirds. Multiplying in geometrical progression at this rate, in twelve years we should have the entire State covered with insects at one to every square inch of surface.

Mr. Walsh computes the average damage done by insects, in the State of Illinois, at 20 million dollars yearly. This means only about 2s. 4d. per acre. If in this country we run over the injuries occasioned by some few of the better-known of our insect enemies,—such as cockchafers, wireworms, weevils, turnip-fleas, cabbage butterflies, aphides, sawflies, &c., without the aid of locusts and Colorado beetles,—we shall certainly think Mr. Walsh's estimate within the mark. Prof. Forbes, however, only takes the damage at one-half, or 10 million dollars annually. On this basis he shows that if the efficiency of the birds could be increased by 5 per cent, 8½ million dollars would be added to the permanent wealth of the State. But the probability is that the number of insects destroyed by birds is far greater. According to Dr. Brewer a pair of European jays have been found to consume half a million caterpillars in bringing up their brood, and to devour a million eggs during the winter. A young mocking-bird, reared from the nest by Robert Forbes, a nephew of the author, ate about 240 red-legged grasshoppers daily.

Surely, in face of such facts, the very instinct of self-preservation—if it still survives among us—might lead us to suppress with some promptitude the bird-shooters, the bird-nesters, and the bird-trappers. But we allow the mischief to go on, and neither Science nor professional humanitarianism raises a protest.

Rough Notes on the Snake Symbol in India in connection with the Worship of Siva.

Prehistoric Remains of Central India.

Archæological Notes on Ancient Sculpturings on Rocks in Kumaon, India, similar to those found on Monoliths and Rocks in Europe.

Description of Stone Carvings collected in a Tour through the Doab from Cawnpore to Mainpuri. By J. H. Rivett-Carnac, F.A.S., F.G.S., F.R.A.S., &c.

These four pamphlets, all reprints from the "Journal of the Asiatic Society of Bengal, are interesting contributions to the archæology of India.

The cobra is worshipped as Mahades or the Phallus, the emblem of Siva. The author refers to the similarity between

the menhirs of Carnac in Brittany and the Siva emblems in India.

The tumuli described in the second pamphlet bear a remarkable resemblance to the barrows of Europe. The inner colonnade at Stonehenge is a repetition of the horse-shoe temples of Ajanta and Sanchi, and the Buddhist tree-worship displayed in the Sanchi *bas reliefs* is the counterpart of the Druidical reverence for the oak.

The agate weapons found in India are supposed to have been shaped by human beings (or anthropoids?) whose reasoning powers were but very slightly developed, and point to an earlier stage of the existence of man than is yet known. The author thinks a geological inquiry into the age of the Nerbudda formation necessary. It is still doubtful whether these formations correspond to the Pleiocene of Europe, and whether these agate implements are really derived from the Nerbudda gravels or from some later deposit.

The Journal of the Royal Historical and Archæological Association of Ireland. Vol. v., Fourth Series, No. 39. Dublin: Ponsonby and Murphy.

We find here but little matter which can legitimately come within our cognizance.

Mr. W. Noble, in a paper on the age of a bronze pin near Enniskillen, remarks that in a bog like that of Cavancarragh a formation of 6 feet would take about a thousand years to grow.

Mr. W. Gray communicates an elaborate illustrated paper on the character and distribution of the rudely-worked flints of the North of Ireland, chiefly in Antrim and Down. He draws no conclusions as to the time when Ireland was first inhabited, or to the character of the earliest settlers.

Archivos do Museu Nacional do Rio de Janeiro. Vol. ii. 1, 2, 3, and 4 Quarterly issues. Rio de Janeiro.

This volume of Transactions, bearing the date 1877, has only just reached us. As a matter of course the value of its contents, which are otherwise interesting, is considerably lessened by its late appearance, since the observations here recorded are already known to the scientific world.

The principal memoirs here included are—"On the Action of the Poison of *Bothrops Jararaca*, the Lance-headed Snake of

Brazil," by Dr. Lacerda Filho. The author enters upon, but does not decide, the important question as to whether the poison of snakes is a chemical individual, the action of which may be weakened to extinction by sufficient dilution, and which does not reproduce itself in the blood of the bitten animal; or whether it is a ferment, soluble or figured? He detects certain fusiform corpuscules in the poison, but he has not satisfied himself that these are the agents in the decomposition of the blood.

The illustrious biologist, Dr. F. Müller, who holds the appointment of "Travelling Naturalist of the National Museum," contributes four memoirs:—"On the Correlation between many-coloured Flowers and Insects;" "On the Sexual Spots of Male Individuals of *Danais Erippus* and *D. Gilippus*;" "On the Odoriferous Organs of the Species *Epicalia Acontius*;" and "On the Odoriferous Organs in the Thighs of certain Lepidoptera."

There is also a paper "On the Geology of the Region of the Lower Amazon," by Prof. O. A. Derby, and a Summary of a Course of Anthropology delivered at the Museum by Dr. Lacerda Filho.

We are very much gratified to find so much attention paid to Biology in a region so fruitful in interesting forms of animal and vegetable life as in Brazil, and where so very much remains to be investigated.

Records of the Geological Survey of India. Vol. xiii., Part 2. 1880.

This issue contains notes, by C. L. Griesbach, F.G.S., on the Palæontology of the Lower Trias of the Himalayas.

Mr. W. King, the Deputy Superintendent of the Survey, communicates a paper on the successful Artesian Wells at Pondicherry, which he has carefully examined in order to throw light on the proposal of similar borings for the supply of Madras. The quality of the water used in many parts of India for domestic purposes, both by natives and British, is such as would be instantly condemned in England. Yet, unless the conclusions of modern sanitarians are entirely erroneous, the effects of the ingestion of decomposing organic matter must be far more deadly in a tropical climate. In India, if anywhere, our cities ought to be absolutely free from pollution in their soil, their air, and their waters.

Prodromus of the Palæontology of Victoria. Decade VI. By F. McCoy, F.G.S., &c. Melbourne: Ferris; Robertson. London: Trübner and Co.; Robertson.

We have here carefully executed figures and elaborate descriptions of organic remains found in Victoria.

The first plate refers to *Macropus Titan*, a gigantic extinct kangaroo, which may be considered the representative of the "Old Man" kangaroo of the present epoch. *Percoptodon Goliah* is another gigantic species, which approaches the *Diprotodon*, and which differs from the true kangaroos in its more complete dentition, and its thicker, shorter, and more equal legs: its remains are found in the Pliocene Tertiary Clays of Lake Timboon.

The fourth plate is devoted to the ear-bones—so-called "cetolites"—of three extinct species of whales.

Plate V. represents the teeth of a gigantic fossil Spermaceti whale found in the Older Pliocene beds of Mordialloc.

Plates VI. and VII. give fossil Mollusca; Plate VIII. a new and abundant species of Hinnites from the Miocene Tertiaries. The last two plates represent sea-urchins from the same formations.

Four more decades are announced as forthcoming.

Notes on the Alluvial and Drift Deposits of the Trent Valley, near Nottingham. A Popular Lecture delivered to the Nottingham Naturalists' Society. By James Shipman. Nottingham: Norris and Cokayne.

The author adduces visible and tangible evidence that the Trent has scooped out the valley in which it flows, and has left on its escarpments terraces marking the stages by which this process was effected. It is perhaps humiliating that such teachings should be needed, but we meet with persons who still entertain the belief that the beds of rivers were made not by them, but for them.

Several important books stand over for review, on account of the want of space.

CORRESPONDENCE.

*** The Editor does not hold himself responsible for statements of facts or opinions expressed in Correspondence, or in Articles bearing the signature of their respective authors.

THE DILEMMA OF HUMAN LIFE.

To the Editor of The Journal of Science.

SIR,—I take the liberty of calling your attention to the subjoined remarkable passage from the "Medical Press and Circular":—

"*Life and Death.*—This is the substance of a review of a book just published on the 'Destruction of Life by Snake-bites, Hydrophobia, &c., in Western India':—'To know that twenty thousand people annually lose their lives in India from snake-bites ought to be enough to arouse the indignant remonstrances of philanthropic folk, especially when we reflect that a twentieth part of that number slain in fair fight would be held sufficient cause for which to hurl an able and useful Government from power. But in all seriousness, if the death-rate in India is to be persistently reduced by the prevention of famines, the destruction of wild beasts, the killing of snakes, the prevention of internal wars and feuds, the punishment for murder, improved sanitation, vaccination, better medical treatment, public dispensaries, purified water, drainage and removal of malaria, and all the other resources of advanced civilisation, some frightful calamity will be brought upon the country by the awful increase in the population without any possible means of increasing the food supply. If these energetic interferences with Nature's laws are to be extended, they must be accompanied by equally determined efforts to feed the additional millions preserved thereby; otherwise we shall be merely creating mischief with one hand, while combating it with the other. The prevention of the twenty thousand annual deaths from snake-bites would increase the population of India by about ten millions every thirty or forty years; and it would be interesting to get the ex-Commissioner's opinion as to the means of feeding this vast increase. And we say this while deeply regretting the loss of life now going on, and recommending his

book to the careful attention of all who profess an interest in their fellow-creatures.' Flourish, then, malaria, snakes, and wild beasts, but save us from ourselves—from an increase of Indian population!"

Surely what is here said of India, if true at all, is equally true of England, and indeed of all old-peopled countries. Will not the labours of sanitary reformers, temperance advocates, and philanthropists generally, if successful, result mainly in an intensification of the struggle for existence. Hence man is confronted with a dilemma from which there appears no escape. Malthusianism, which all political economists favour in their hearts, is useless, since the race or nation which adopts it simply effaces itself, and is overbalanced by its rivals. Is, then, the safety or the very existence of a commuity only to be bought by the misery of a large proportion of its component units.—I am, &c.,

EOSPHOROS.

CRUELTY OF THE STRUGGLE FOR EXISTENCE.

To the Editor of the Journal of Science.

SIR,—When we point out the harshness of the law of Natural Selection we are sometimes told that if the triumph of the strong involves a certain amount of suffering, the triumph of the weak would involve the degradation of the race. But we may surely ask, Is there any necessity that the weak should be called into existence to be trampled down? Suppose it were a law of "Nature" that an organism temporarily or permanently diseased or debilitated should be *ipso facto* temporarily or permanently incapable of reproduction,—would not the larger part of the weak never come into existence? would not the place which they now occupy until trodden down remain open for the strong, and would not an immense amount of misery be prevented? But to a very large extent the opposite rule prevails: sickly trees often yield the most numerous fruits or seeds, and consumptive persons have very frequently the largest families.—I am, &c.,

NEMO.

ABSTENTION FROM FLUIDS.

To the Editor of the Journal of Science.

SIR,—The question of the power of the human frame to endure fasting from solids, as exemplified in the case of Dr. Tanner, U.S., he taking only fluids in small quantities, is now amusing the scientific world. Accepting, in good faith, the experiment so for as the trial and his recovery has proceeded, we have on record the fact that man has the power of fasting for forty days without vital injury. The case of the convict at Cusana (reported in the Paris News in the 'Times,' August 10th, 1880), who starved himself, is in evidence.* He abstained from fluids and solids, and did not succumb until thirty days.

A case (for a long time) within my knowledge, the details of which are below, of a labouring man who abstained from taking fluids of any kind for two periods,—one of five and one of seven months,—appears to me of practical importance, especially in a military point of view, in cases where water is unattainable.

C— P—, in the peasant condition of life, a great advocate of the Temperance movement, in a moment of excitement upon the subject, maintained that not only could a man abstain from beer and alcoholic drinks, but that the drinking of any fluid was totally needless, and that life and strength could both be preserved without the imbibition of any fluid, provided suitable food, of a commonplace character, could be procured; and that he in his own person would prove it.

C. P. is a labouring man (almost uneducated), but of an enquiring mind. The basis on which he built his theory was that all substances contain more or less of water, and thus the question was one of the selection of the food; and when the proper selection of a common and easily attainable product was used, fluids were quite unnecessary to support life and to engender the energy needed in a laborious occupation. At the time, and some years before he entered upon his experiments, I should say that he was not only a teetotaller, but a vegetarian also.

On his first trial (five months) he fed wholly upon potatoes and butter, taking three meals a day, consisting (each meal) of three and a half pounds of potatoes, boiled and mashed with two ounces of butter: during this period he took *no fluid* of any kind, and only ended the probation when it became impossible for him to obtain potatoes in a fitting state. He then went on

* A mason, aged 26, condemned to four years' imprisonment at Cusano, has starved himself to death. From the day of his sentence he refused to take food, and, no compulsion being resorted to, he died at the end of thirty days. His funeral was purely civil, the priests considering him a suicide.

with his usual vegetarian diet, with which he drank water, sometimes milk, tea, or coffee.

The following year C. P. made his second experiment, during which time (*seven months*) he took three meals a day, each consisting of twelve ounces of apples and twelve ounces of brown bread (made from the whole product of the grain), and as before, did not drink a single drop of fluid.

The experiments were made in the years 1863-64, when C. P. was about twenty-six years old. He states that during the time he dieted himself he was as able for his work as at any other period of his life. He is now forty-two—a stout, active man. He continues his teetotallism, but for the last three or four years has given up a strict vegetarian diet, thinking his powers were giving way, but which were wholly restored on his resumption of an *occasional* meat regimen.

In conclusion, I would say I have known C. P. for many years, and believe him incapable of a falsity of statement. He is strong, robust, and I should say an untiring worker.

To verify my facts I sent for C. P., who told me what I have stated above, and which statement is in accordance with my memory of the facts gleaned soon after they occurred. There are probably many other particulars which a physiologist might require, and should any of your readers, *for the purposes of Science*, desire to test the above narrative, the address of C. P. is at their service, and may be obtained on application to the Editor. I append my name as a proof of *bona fides* on my part. —I am, &c.,

S. BILLING.

August 12, 1880.

THE CONSTITUTION OF THE EARTH.

To the Editor of the Journal of Science.

SIR,—Geologists, having abundance of evidence that portions of the surface of Earth once beneath the waters of the ocean had been elevated into dry land, upon the supposition that the matter of our planet is a fixed quantity, naturally sought for evidence of a corresponding depression. Mr. Darwin was supposed to have found this evidence in the formation of coral reefs in the Southern Hemisphere. I have shown, by reference to the highly interesting discoveries made in connexion with the exploring voyage of H.M.S. *Challenger*, that there is "no necessity to assume that the submarine coral mountains of the Pacific or Indian Ocean afford evidence of a subsidence of the crust of the

Earth exactly representing its elevation elsewhere. (See "Constitution of the Earth," pp. 286, 287.) I am pleased to learn, from the abstract of a paper read at the Royal Society of Edinburgh by Mr. John Murray, and published in "Nature" of August 12th inst., that this seems to be the conclusion arrived at by scientific members of the *Challenger* Expedition. The object of the paper is "to show, *first*, that while it must be granted as generally true that reef-forming species of coral do not live at a depth greater than 30 or 40 fathoms, yet that there are other agencies at work in the tropical oceanic regions by which submarine elevations may be built up from very great depths, so as to form a foundation for coral reefs; *second*, that while it must be granted that the surface of the Earth has undergone many oscillations in recent geological times, yet that all the chief features of coral reefs and islands can be accounted for without calling in the aid of great and general subsidences."—I am, &c.,

ROBT. WARD.

August 18, 1880.

NOTES.

THE Birmingham Philosophical Society has established a fund for the endowment of research. Mr. Darwin has contributed £25.

The French Government has assigned to M. Pasteur the sum of 50,000 francs, to assist him in conducting his important researches on the contagious diseases of domestic animals.

M. Pasteur has communicated to the Academy of Sciences a memoir on the Etiology of Cattle-plague. He concludes that the germs of the peculiar bacteria which cause the disease, and which are of course present in the carcases of the animals which have perished, are brought to the surface of the earth by the agency of earth-worms. Hence he recommends that animals which die of "zymotic" disease should be buried in poor, chalky, or sandy soils, where earth-worms are rare. (Might not similar precautions be useful in disposing of the bodies of human beings who have died of pestilential diseases?)

M. Max Cornu has observed the alternation of generations in the parasitic Fungi known as Uredineæ.

M. Vaillant has made a series of observations on the reproduction of *Pleurodeles Waltlii*.

M. N. Poletaien has demonstrated the existence of salivary glands in the Neuroptera, the existence of which had been long denied.

M. C. Richet, in a paper communicated to the Academy of Sciences, gives an account of the action of strychnine upon the Mammalia. Under the influence of artificial respiration very large doses of strychine can be supported without the production of immediate death, and the phenomena produced differ decidedly from those observed after the ingestion of small doses. In very large quantities the poison acts somewhat like curare and somewhat like chloral.

"*Vivisection*.—The attentive reader of ephemeral literature cannot fail to be struck by the rapidly increasing number of journalists who weekly inveigh against the horrors of vivisection. It may be that the anti-vivisection fanatics are blameable for the excitation of popular indignation against a practice of which those most ignorant of physiological investigations consider themselves well able to be judges. The utter nonsense which greets the eye almost daily, and even in papers well informed on most ordinary subjects, though it receives a merited contempt

from the instructed reader, is yet calculated to tell disastrously against the progress of research by stimulating a rabid opposition to scientific needs on the part of the multitude. As the supporters of the anti-vaccination movement have gathered strength from the unwise silence maintained by the profession in regard to truths whose incontestable nature they clearly apprehend, so it is with the vivisection question. In all controversy where fact and science are pitted against ignorance and assumption, the issue has never been nor will be in doubt. But the insidious influence of oft-repeated and uncontradicted assertions will do irreparable injury unless an effort ere long be made to stem the advancing tide of prejudice and ignorance." In making the above extract from the "Medical Press and Circular" we wish to point out that in all such agitations the party of attack has a great advantage. A falsehood can always be stated in fewer words than are required for its exposure, and this often in proportion to its very impudence. In this case, too, whilst the attack is made in journals read by the general public, in advertisements, and posting-bills, the defence has been almost exclusively confined to professional and scientific organs which never reach the multitude. Unless active steps are taken experimental biology will soon be entirely crushed, so far as the United Kingdom is concerned.

We are glad to learn that the Legislature is not wholly unmindful of the necessity of securing more efficient protection for wild birds. The existing Acts are to be consolidated and somewhat extended. The Duke of Argyll, however, pointed out that the new Bill had been carelessly drawn up:—"Of the sixty-eight birds enumerated therein fully half were simple synonyms, and one bird was in several cases mentioned two or three times over under different names." The omission of the woodpecker and the kingfisher is to be regretted. But the provisions of the Bill are of little moment unless when it becomes law it is to be strictly enforced.

Attention has been called by the "Standard" to the approaching extirpation of not a few of the most beautiful species of wild flowers, ferns, &c. We can, of our own knowledge, confirm many of the writer's statements. We know localities where the hart's-tongue, the beech- and oak-fern grew freely a dozen years ago, but where they would now be quite as difficult to find as would a deposit of diamonds.

According to M. Daubrée the Paris Museum receives from time to time spurious meteorites, sent in good faith, and sometimes by persons of scientific standing, such as Le Verrier and Becquerel.

The removal of the Natural History Department of the British Museum to its new site in Cromwell Road, South Kensington,

has actually commenced. Though it was universally admitted that there was great lack of room in the old building, the situation of the new Museum, save in strictly official circles, is not admired. The respective keepers of the mineralogical and geological departments, Prof. N. S. Maskelyne, F.R.S., and G. R. Waterhouse, have resigned, and have been succeeded by Mr. Lazarus Fletcher, F.G.S.. and Dr. H. Woodward, F.R.S.

Mr. Searles V. Wood, in a letter to the "Geological Magazine," contends, in opposition to Dr. Croll's "eccentricity theory," that the climate of the Glacial period must have been an uniform diminution of mean temperatures as they now exist, and that the period hence resulted from a cosmical cause, wholly unconnected with geographical conditions and ocean currents,—that is to say, to a decrease in the heat-emitting power of the sun.

Dr. Croll, in the "Geological Magazine," considers that the perpetual snow of high mountains is due to the want of aqueous vapour in the upper regions of the atmosphere, where the heat received from the sun is radiated off into space.

According to Dr. Bogomelow and Dr. Koehler, *Blatta orientalis*, the Orthopterous insect absurdly called the "black-beetle" in England, is likely to play an important part in the treatment of dropsy and albuminuria. The insects are stupefied with chloroform, dried and ground to powder, and taken in doses of 3 decigrammes.

Dr. Kebler, of Cincinnati, has studied the physiological action of platinum. In frogs the chief symptoms observed were increasing paralysis of the voluntary movements, convulsive spasms of the extremities, loss of muscular irritability, and death. In Mammalia the direct action upon the muscles is not perceptible, but death ensues in consequence of paralysis of the abdominal vessels. For dogs five- to six-thousandths of their own weight is a fatal dose.

According to MM. Van Tieghem and Bonnier ("Bulletin de la Soc. Botan. de France," xxvii., p. 83) the seeds of *Acer pseudoplatanus* form an exception to the rule that seeds are not injured by cold.

The editor of "Science," a new and ably-conducted American contemporary, states that during the fifteen minutes he remained in company with the well-known Dr. Tanner, two opportunities were presented when he might have taken food unobserved by his watchers, who were not always in the same room.

In the brain of an adult chimpanzee, described by Dr. Spitzka, the right side presented a well-developed first transition gyrus, evident and exposed to view as in the human subject, whilst on the left side it was concealed as in the ordinary chimpanzee type.

A Society of American Taxidermists has been formed, and is about to hold an exhibition, in which, in addition to "Taxidermy proper," there will figure "ornamental articles in which portions of an animal are used,"—in other words, Taxidermy improper.

Mr. A. S. Packard, jun., calls attention to a curious case of mimicry, He observed an Egerian moth, *Trochilium polistiforme*, so closely resembling the wasp, *Polistes fuscus*, that he was at first afraid to handle it.

M. Magnin has observed the microbia found in different kinds of vaccine matter, taken respectively from the horse, the cow, and from a human subject. All three are exactly similar in form, but the last-mentioned kind is only one-fifth the diameter of the other two.

Carriere has repeated and confirmed the statements of Spallanzani and Schäffer, on the reproduction of amputated parts in snails. He finds that the eyes, the tentacles, and the lips were completely restored, but that an injury to the supra-œsophageal ganglion proved invariably fatal. The regeneration of the eye was quite similar to its first formation in the embryo.

Karl Pettersen ("Tromsö Museum Aarhefter," ii., p. 65), after a very extensive series of researches, concludes that the rounding and smoothing of the surfaces of rocks, the grooving and scoring of their sides, are not always of unquestionably glacial origin. They are often post-glacial, since it can be shown that similar phenomena are in the course of origination in the present littoral zones. The conclusions based upon the glacial theory, as to the alternations in the level of the Scandinavian peninsula during the post-tertiary times, cannot, as a whole, be pronounced scientifically justified. There is no direct proof that the Scandinavian peninsula during the last portion of the Glacial epoch was more elevated than at present, nor that it has been subject to a continental depression during the latter portion of the same epoch. It is, however, a fact that the peninsula has been rising in the Post-tertiary period.

Mr. H. D. Minot, writing in the "American Naturalist," thinks that in England wild birds are better protected than in America, and are consequently more easily observed by the naturalist. He considers the birds of England, as a whole, inferior to those of New England, both in plumage and song. He met with mosquitoes on the Derbyshire moors.

In the same journal Prof. A. N. Prentiss and Mr. W. A. Henry record some experimental attempts to destroy Aphides by sprinkling with yeast. The results were entirely negative.

Dr. H. Behr communicates to the "Rural Press" (Californian) an interesting paper on "Changes in Plant Life on the San Francisco Peninsula." Commenting on the herbaceous immi-

gration from Europe and Africa, he remarks:—"Our original vegetation has very little power of resistance. Its very variation is a proof of a certain want of vitality, for any more vigorous organisation, by superseding the weaker ones, would have produced originally the monotony developed at present by the immigration of foreign plants." It is lamentable that plants triumph in the struggle for existence in an inverse ratio to their beauty and utility.

According to a report by Dr. Delpech, on Apiculture in Paris, it appears that the bees, when they penetrate into sugar-refineries, will not touch treacle if pure syrups are to be found, and in places where both cane and beet-root syrups are in store they completely ignore the latter.

The following mode of preparing glycerin-gelatine for mounting microscopical objects is given by Herr Otto Brandt, Secretary of the Berlin Microscopical Society:—A quantity of the best white gelatine is to be cut up coarsely, and laid overnight in a vessel with distilled water, so that it may swell up during the night. In the morning it is taken out, squeezed in the hand, and placed to melt (without adding fresh water) in a glass cup in the water-bath; as soon as the mass has become fluid add to it (stirring continually) about one and a half times as much glycerin as was taken of the gelatine. Filtering is a matter of vital importance; filtering-paper does not allow the fluid to pass through sufficiently, and flannel makes it worse than before. It is best cleared by being strained through a glass funnel with some spun glass pressed into the lower part of the cone: this must be kept warm during the process of filtration in a suitable water-bath. Some drops of carbolic acid should be added to the fluid product of the filtering.

Mr. R. Bullen Newton, Assistant Naturalist, under Professor Huxley, in the Museum of Practical Geology, Jermyn Street, has received an appointment in the geological department of the British Museum.

ERRATA.

Page 368, line 10 from bottom, *for* "temperate" *read* "temperature."
Page 370, line 21 from bottom, *for* "compact" *read* "impact."
Page 373, line 8 from bottom, *for* "5 per cent" *read* "5°."
Page 374, line 15, *for* "simplicity" *read* "ellipticity."